Psychometric Testing of the TeamSTEPPS® 2.0 Team Performance Observation Tool

Mary Beth R. Maguire

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Psychometric Testing of the TeamSTEPPS® 2.0 Team Performance Observation Tool

By

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TESTING OF THE TPOT

Abstract

Approximately 213,000 deaths occur in hospitals each year as a result of preventable adverse events (James, 2013). Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS®) is an evidence-based teamwork curriculum intended to minimize preventable adverse events through improved medical team performance. One way to provide evidence of team performance is through evaluation. The Team Performance Observation Tool (TPOT) is a TeamSTEPPS® curriculum instrument that can be utilized to evaluate the effectiveness of team performance. In 2014, TeamSTEPPS® 2.0 was released and an updated version of the TPOT was published. Limited reports of validity and reliability of the TPOT are currently available. The utility of the instrument is restricted due to this limited knowledge.

The purpose of this descriptive, quantitative study was to establish baseline psychometric properties of the TeamSTEPPS® 2.0 TPOT. Using the Dickinson and McIntyre Teamwork Model as a guiding theoretical framework, fifty-one TeamSTEPPS® trained healthcare professionals were recruited to review a series of up to five pre-recorded, 10-minute simulated team emergency scenarios. Study participants evaluated the recordings using the TeamSTEPPS® 2.0 TPOT instrument along with the Team Emergency Assessment Measure (TEAM) to establish concurrent validity. Data analysis provided baseline psychometric properties of the TeamSTEPPS® 2.0 TPOT via content, construct, and concurrent validity. Reliability measures included internal consistency, test-retest, and inter rater analysis.

Study findings suggest a modified version of the TeamSTEPPS® 2.0 TPOT is valid and reliable. Evidence has been provided to support the use of a revised TPOT instrument for healthcare team training. Improved performance of healthcare teams holds promise to improve the safety of the medical care provided and decrease the rate of preventable adverse events.
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Chapter One
Introduction

Susan Sheridan became famous for all the wrong reasons. In 2004, Susan Sheridan was asked to lead the World Health Organization’s Patients for Patient Safety initiative (World Health Organization, 2014). Ms. Sheridan was highly qualified for this role due to her personal experience. In 1995, she and her husband Pat welcomed their first child Cal. He was born a healthy child until six days after his birth when severe brain damage occurred as a result of kernicterus; severe jaundice that was not properly identified or treated. It was determined Cal’s irreversible brain damage was a result of a preventable adverse event (PAE) committed by the healthcare team. Tragically, Ms. Sheridan’s world would turn upside down again in 2002, after her husband’s diagnosis of spinal cancer failed to be communicated. Susan Sheridan learned a startling fact; patients admitted to hospitals in the United States risk being harmed by inactions of the healthcare team.

Healthcare teams, the very people entrusted by communities to improve health, are often responsible for harming and sometimes killing patients. James (2013) estimates 213,000 deaths per year are attributed to PAEs occurring in hospitals. Deaths due to PAEs are the third leading cause of death behind heart disease (597,689 deaths) and cancer (574,743 deaths) (Centers for Disease Control and Prevention, 2013). The cause of PAEs can be separated into five distinct categories: errors of commission, errors of omission, errors of communication, errors of context, and diagnostic errors (James, 2013). One strategy to improve PAEs is through improved function of the healthcare team.

High functioning teams “win wars, deploy humans into space and return them safely to earth, and save countless numbers of lives in health care settings” (Clapper & Kong, 2012, p.367). In 2006, the Agency for Healthcare Research and Quality (AHRQ), in collaboration with
the Department of Defense, created an evidence-based teamwork system for healthcare professionals and released training programs to the public (King & Toor, 2013). The organizations titled the program TeamSTEPPS® which stands for Team Strategies and Tools to Enhance Performance and Patient Safety. The TeamSTEPPS® curriculum is free of charge and is composed of four core competencies: leadership, situation monitoring, mutual support, and communication. In 2014, the TeamSTEPPS® curriculum was streamlined and updated to the current TeamSTEPPS® 2.0 version (PR Newswire, 2014).

In November 2006, a national implementation plan began to disseminate the TeamSTEPPS® curriculum nationwide. The goal is wide-scale dissemination to all members of the healthcare team (King et al., 2013). Nursing education has the responsibility to prepare graduates with the skills required of high functioning healthcare team members, and utilization of the TeamSTEPPS® tools are a convenient and cost-effective approach.

One strategy for TeamSTEPPS® instruction is through the use of Simulation Based Team Training (SBTT). SBTT provides a vehicle for rehearsing, teaching, and analyzing complex patient situations while ensuring patient safety (Rosen et al., 2010). The knowledge, skills, and attitudes of participants can be simultaneously observed through SBTT. Participants of SBTT have the opportunity to participate in activities under the guidance of faculty who provide feedback and coaching to improve performance.

Evaluation of performance during SBTT is a constructive way to provide evidence of team function. The TeamSTEPPS® 2.0 Team Performance Observation Tool (TPOT) (Figure 1) is an instrument that can be utilized to evaluate the effectiveness of SBTT among healthcare teams (AHRQ, 2014). There is however, limited report of reliability or validity the TeamSTEPPS® 2.0 TPOT when used to evaluate healthcare team performance.
Purpose of Study

The purpose of this descriptive, quantitative study was to perform baseline psychometric testing of the TeamSTEPPS® 2.0 TPOT among a sample of TeamSTEPPS® trained healthcare professionals. Seven team science experts participated to provide an assessment of TPOT item relevance in an effort to describe content validity. Fifty-one TeamSTEPPS® trained healthcare professionals completed a total of 247 TPOT observations of simulated team events to establish construct validity. The video recordings were of nursing student teams enrolled in an acute deterioration course (NURS 4490) in Fall 2011 and Spring 2012 semesters. Study participants scored between one and five recordings using the TeamSTEPPS® 2.0 TPOT and the Team Emergency Assessment Measure (TEAM) (Figure 2). The TEAM instrument served as a measure of concurrent validity. Study participants viewed the recordings and provided instrument scoring through an online survey system if completing the evaluation independently or a paper survey, if completing the evaluation in a group setting. Data collection took approximately sixty minutes and participants were awarded a desk clock valued at twenty-five dollars at the conclusion of data collection. Eleven participants were randomly selected and invited through an online survey two weeks after data collection to evaluate retest reliability. Participants serving as retest raters received a fifty-dollar Visa gift card for their participation. The Dickinson and McIntyre Teamwork Model served as the theoretical framework to guide the investigation. Content validity index, construct validity, and concurrent validity of TPOT data were explored in an effort to describe baseline psychometric properties of the TeamSTEPPS® 2.0 TPOT. Reliability was explored through the analyses of internal consistency, test-retest, and inter rater reliability. Establishing psychometric properties of the TeamSTEPPS® 2.0 TPOT served to
provide evidence of a valid and reliable instrument for use among healthcare professionals evaluating team performance.

**Significance of the Study**

The provision of medical care requires a team approach. Healthcare professionals are increasingly aware that interprofessional collaboration and effective team function are essential for improved patient care and safety (Bajnok, Puddester, MacDonald, Archibald, & Kuhl, 2012). The TeamSTEPPS® program encourages interprofessional collaboration and teaches strategies to promote effective team performance. The TeamSTEPPS® 2.0 TPOT addresses each of the program’s core competencies. However, psychometric properties of the tool have been underreported. Establishing psychometric properties of the TeamSTEPPS® 2.0 TPOT provides evidence that can be translated to nursing practice, nursing education, nursing research, and healthcare.

**Significance of Study for Nursing Practice**

In January 2000, the IOM published the report *To Err is Human* (Farley & Battles, 2009). This groundbreaking publication stimulated national efforts to improve patient safety by identifying major problems of the United States medical system. At that time, Congress charged and funded the AHRQ to improve healthcare safety. Over the next six years, more than 300 research projects and other activities were funded to address diverse safety issues and practices.

In 2001, the AHRQ established a patient safety strategy consisting of four elements. The four elements identified were: 1) identifying threats to patient safety, 2) identifying and evaluating effective patient safety practices, 3) teaching, disseminating, and implementing effective patient safety practices, and 4) maintaining vigilance (Agency for Healthcare Research
and Quality, 2013). The overarching goal of the patient safety strategy was to create a culture of safety.

In 2006, after a collaborative effort between the AHRQ and the Department of Defense, the TeamSTEPPS® program was released. The program supported element three: teaching, disseminating, and implementing effective patient safety practices. The national implementation plan continues in an effort to disseminate TeamSTEPPS® training to all members of the healthcare team.

Today, patient safety remains a key driver in healthcare (Kangasniemi, Vaismoradi, Jasper, & Turunen, 2013). Patient safety is defined as the absence of preventable harm to a patient during the provision of healthcare or the prevention of errors and adverse events by the healthcare team during the delivery of care (de Vries, Ramrattan, Smorenburg, Gouma, & Boermeester, 2008). Nurses are the largest members of the healthcare team and serve at the frontline of the patient safety movement (Clancy, Farquhar, & Sharp, 2005). For this reason nurses have been actively involved in the TeamSTEPPS® national implementation plan. As of 2013, approximately 25% of hospitals in the United States had begun training, and 90% of hospitals and clinics in the Department of Defense had received training (King & Toor, 2013). The use of psychometrically sound instruments to evaluate the effectiveness of TeamSTEPPS® training through team performance measures is essential to provide quantification of healthcare members’ team skills for assessment and quality improvement initiatives.

The healthcare hierarchy is complex. Healthcare demonstrates a traditional layered organizational structure “with nursing subordinate to administration, doctors, regulators, and patients” (Croft & Cash, 2012, p.227). Roberts (1983, 2000) believed these hierarchies developed as hospitals became major care centers and with this change, a lack of control and
autonomy developed for nurses. The change benefited hospitals and physicians but created problems for nursing. Nurses are the largest group of healthcare providers (Rodwell & Demir, 2012) however the medical hierarchy results in an overall lack of power and control for nurses. The TeamSTEPPS® program seeks to flatten the hierarchy through competencies designed to improve communication, advance leadership skills, and strengthen mutual support among team members.

This study provides new knowledge regarding an instrument directly related to TeamSTEPPS® competencies. Psychometric testing of the TeamSTEPPS® 2.0 TPOT positively impacts nursing practice because the use of a valid and reliable instrument can be employed to measure team performance immediately after instruction as well as to evaluate the retention of team strategies through repeated assessments over time. Nurses in practice can utilize this valid and reliable instrument rooted in TeamSTEPPS® 2.0 principles by which team performance can be measured.

Significance of Study for Nursing Education

Knowledge from this study is significant to nursing education because the TeamSTEPPS® 2.0 TPOT serves as an instrument for educators to quantify team performance of nurses from a summative, formative, or both summative and formative perspective. Nursing education is charged with preparing nursing graduates who possess the knowledge and skills necessary to provide safe nursing care in a complex healthcare environment. The Essentials of Baccalaureate Education for Professional Nursing Practice (American Association of Colleges of Nursing, 2008) defines nine curricular elements that provide a framework for baccalaureate nursing education. Three of the nine essentials reflect teamwork skills addressed in the TeamSTEPPS® 2.0 TPOT.
The first essential to address teamwork is Essential Two, which states, “Basic Organizational and Systems Leadership for Quality Care and Patient Safety” (American Association of Colleges of Nursing, 2008, p.2). Sample content stated with Essential Two includes, “leadership development…communication, including elements, channels…conflict resolution, optimizing patient care outcomes” (American Association of Colleges of Nursing, 2008, p.15-16). The TeamSTEPPS® 2.0 TPOT specifically evaluates elements of leadership, communication, and conflict resolution with the goal of improving team performance to optimize patient outcomes.

The second essential to address teamwork is Essential Six, which states, “Interprofessional Communication and Collaboration for Improving Patient Health Outcomes”. The rationale for Essential Six calls for graduates to enter the profession with “baseline competencies and confidence for interactions and with communication skills that will improve practice, thus yielding better patient outcomes” (American Association of Colleges of Nursing, 2008, p.23). Once again, the TeamSTEPPS® 2.0 TPOT addresses communication skills and team structure to allow the establishment of competency measures in an effort to improve team performance.

The third essential to address teamwork is Essential Eight entitled, “Professionalism and Professional Values” (American Association of Colleges of Nursing, 2008, p.22). Within Essential Eight the baccalaureate program prepares the nurse to demonstrate professionalism in attention to demeanor and respect for others, to communicate to the healthcare team one’s personal bias on difficult healthcare decisions, and to recognize the impact of attitudes, values and expectations on patient care (American Association of Colleges of Nursing, 2008). The TeamSTEPPS® 2.0 TPOT supports Essential Eight because TeamSTEPPS® 2.0 TPOT seeks to
quantify the ability of the team to effectively communicate and resolve conflict in an effort to support professionalism and professional values.

Psychometric testing of the TeamSTEPPS® 2.0 TPOT also aligns with research priorities set forth by the National League for Nursing (NLN). The 2012-2015 NLN research priorities address three key areas of priority for nursing education: leading reform in nursing education, advancing the science of nursing education and developing national and international leaders in nursing education (National League for Nursing, 2014). Leading reform in nursing education calls for establishing education-practice linkages, specifically, identification and evaluation of education models focused on delivery of team-based, patient-centered care to diverse patient populations in a variety of clinical settings. The utility of the TeamSTEPPS® 2.0 TPOT is that it can be used in a variety of patient care areas where team-based care is delivered. Therefore, psychometric testing of the instrument was the first step toward establishing education-practice linkages related to team-based performance. Findings from this study advance the science of nursing education beyond the baccalaureate degree to all nursing degree programs by establishing psychometric properties of the TeamSTEPPS® 2.0 TPOT instrument which can be utilized in education research related to team performance.

The TeamSTEPPS® 2.0 TPOT not only supports nursing education recommendations set forth by the AACN and the NLN, the TeamSTEPPS® 2.0 TPOT also supports national safety initiatives described by the Quality and Safety Education for Nurses (QSEN, 2014) Institute. The QSEN project began in 2005 with the goal to “address the challenge of preparing future nurses with the knowledge, skills, and attitudes (KSAs) necessary to continuously improve the quality and safety of the healthcare systems in which they work” (QSEN, 2014). The QSEN Institute identifies six pre-licensure KSAs four of which support improved team performance.
The four KSAs to support team performance are: teamwork and collaboration, evidence-based practice, quality improvement, and safety. The QSEN Institute provides an extensive library of teaching strategies free of charge to nurse educators however; only one evaluation tool is available, the Systems Thinking Scale (QSEN, 2014), which is intended for individual measure of systems thinking in quality improvement. The QSEN Institute does not provide an instrument to quantify team performance. Psychometric testing of the TeamSTEPPS® 2.0 TPOT provides valuable data that supports efforts of the QSEN Institute and can serve as an additional resource to nurse educators in an effort to improve the preparation of the nursing workforce.

Nursing education must not only follow accrediting agency regulations and national safety initiatives, educators are also responsible to address the needs of today’s nursing student. Benner and colleagues call for a radical transformation in nursing education to teach for a sense of salience (Benner, Sutphen, Leonard, & Day, 2010). The majority of today’s learners are of the Millennial generation born between 1982-2004 (Kaifi, Nafei, Khanfar, & Kaifi, 2012). Learners of this generation seek knowledge that is research based, relevant to contemporary issues, rational in presentation, and presented in a relaxed environment (Price, 2009). The simulated learning environment allows participants the opportunity to engage in meaningful activities relevant to contemporary nursing practice in a safe and reproducible environment. Knowledge from this study serves to provide greater evidence of a valid and reliable instrument that can be used in the simulated learning environment to evaluate student teamwork performance.

In summary, knowledge from this study positively influences nursing education in several ways. First, proper assessment through the use of a validated instrument to evaluate student teamwork skills aligns with professional preparation as described by nursing
organizations. Second, the characteristics of today’s student support use of the simulated clinical environment. The TeamSTEPPS® 2.0 TPOT is an instrument that can be effectively used in the simulated clinical environment to evaluate students’ team performance and strengthen outcome measures of the simulation pedagogy. Finally, because a student’s team performance has been evaluated during their educational program, graduates can enter practice aware of team strategies and how one’s skills influence the effectiveness of the entire healthcare team. Nurse educators can prepare a nursing workforce equipped with the skills necessary for contemporary nursing practice.

Significance of Study for Nursing Research

Nursing research provides the scientific basis for the practice of the profession. Societal issues influence the direction of nursing research. Knowledge from this study is significant to nursing research because it contributes to several issues relevant to contemporary nursing practice. Findings from the study support the maturation of the clinical simulation pedagogy, provide a mechanism to objectify observable teamwork behaviors in support of the TeamSTEPPS® National Implementation Plan, and strengthen nursing education by providing evidence of a valid and reliable instrument for educators to utilize when evaluating team performance.

Clinical simulations aim to imitate real patients, anatomic regions, clinical tasks and/or mirror the real-life circumstance in which healthcare is provided (Scalese, Obeso, & Issenberg, 2008). The use of clinical simulation in nursing education has been reported as far back as the early 1900s with the use of the first task-training doll known as Mrs. Chase (Sexton, Stobe, & Lessick, 2012). The modern era of clinical simulation began in the early 1960’s when Asmund Laerdal created Resusci-Anne, which was commonly used during the instruction of
cardiopulmonary resuscitation (Nehring & Lashley, 2009). Technological advancements throughout the late 1990’s and early 2000’s resulted in mannequins that possessed greater realism (fidelity). However, as technology improved, the mannequins were costly to purchase and required a steep learning curve to program and operate (Sanford, 2010). Today’s high-fidelity mannequins are considerably less expensive, offer pre-programmed scenarios and a friendlier user-interface, making operating easier. The new technology allows educators the opportunity to engage learners in new scenarios that mimic critical thinking and reflection upon lived experience.

The improved mannequin availability, along with the safety and reproducibility of the simulated clinical environment, suggests a place for high-fidelity simulated clinical learning in nursing education. However, not all educators are quick to agree. Schiavenato (2009) identified simulation as both limited and restrictive. The author suggested further research in the area as well as the creation of a theory that would provide greater evidence and further support the use of clinical simulation in nursing education. Knowledge from this study provides greater evidence of a valid and reliable instrument to use in the clinical simulation environment and supports maturation of simulation pedagogy.

In addition to the maturation of simulation pedagogy, this study provides additional evidence of an instrument to objectify teamwork behaviors in support of the TeamSTEPPS® National Implementation Plan. The TeamSTEPPS® National Implementation Plan has been set forth by the AHRQ for healthcare professionals across disciplines (Agency for Healthcare Research and Quality, 2013). Nursing scholars must therefore participate in the construction of knowledge related to the success of the program. One way scholars can contribute to new knowledge is to provide outcome measures related to team performance. Scholars can choose to
examine team performance among pre-licensure nurses, or teams in practice. Psychometric evidence of the TeamSTEPPS® 2.0 TPOT is another step toward providing evidence of a valid and reliable instrument that addresses each domain of the TeamSTEPPS® curriculum.

Finally, few researchers have evaluated outcomes of learning when using the simulated clinical learning environment (Fero et al., 2010). Early simulation research has been qualitative in design or sought to explore the self-reported satisfaction and confidence of participants (Kardong-Edgren, Adamson, & Fitzgerald, 2010). Objectifying performance evaluation in nursing education is “complicated by the problem of trying to evaluate each domain separately when in most instances, several behaviors occur simultaneously” (Kolb & Shugart, 1984, p.84). The purpose of the TeamSTEPPS® 2.0 TPOT is to objectify team performance, which requires adequate psychometric testing to ensure it is a valid and reliable instrument. This study filled this knowledge gap.

Significance of Study for Healthcare

Healthcare teams are complex. Effective teams demonstrate a high level of technical and nontechnical skills. Members of healthcare teams are “required to transcend professional boundaries and, arguably, engage in participative decision-making practices” (Sutton, Liao, Jimmieson, & Restubog, 2011, p.10). The ability to measure team performance is important to determine how best to train clinicians for the complexities of practice. Challenges to the measurement of team performance include the following: a lack of standardized communication and procedures, a focus on training individuals and not team competencies, and healthcare that involves high levels of variability and multidisciplinary work (Jeffcott & Mackenzie, 2008). Generic metrics that are valid and reliable are necessary to achieve “a more comprehensive understanding of medical team dynamics and the potential impact on patient outcomes” (Jeffcott
& Mackenzie, 2008, p.191). Knowledge from this study is significant to healthcare because research findings describe the validity and reliability characteristics of the TeamSTEPPS® 2.0 TPOT. Healthcare educators can utilize the instrument for multidisciplinary training in an effort to improve the quality of care provided in healthcare environments where team performance is essential.

Quality healthcare is less expensive healthcare. The economics of poor quality healthcare are significant. In 2008, medical errors cost the United States $19.5 billion (Andel, Davidow, Hollander, & Moreno, 2012). The economic impact of medical errors is estimated to be even higher at $1 trillion annually when quality-adjusted life years are applied to those that die. “Quality care not only saves lives but is better, more efficient, and by definition, less wasteful. It is the right care, at the right time, every time. It should mean that far fewer patients are harmed or injured” (Andel et al., 2012, p.39). Improved performance of the healthcare team can positively impact quality and decrease costs as PAEs will be decreased.

The provision of medical care is bound by four ethical principles: autonomy, non-maleficence, beneficence, and justice (Page, 2012). Society places trust in healthcare providers that they will ensure patient autonomy, avoid harm to patients, ensure the right thing is being done for each patient, and treat patients in a fair/just manner. Non-maleficence and beneficence are the primary ethical principles of concern when considering the high frequency of medical errors and the catastrophic harm patients can experience as a result. Exploring how healthcare teams function, training teams to improve performance, and evaluating team performance are not only significant to healthcare, but society at large. Psychometric testing of the TeamSTEPPS® 2.0 TPOT benefits society because improved knowledge of the validity and reliability of data
produced from the instrument can be utilized in team training with the goal of improved team performance.

Finally, the TeamSTEPPS® 2.0 curriculum is strengthened by this study. The curriculum reports validity and reliability of the TeamSTEPPS® Attitude Questionnaire, a team attitude assessment, but such data were not previously available regarding the TPOT. This study provides evidence of a valid and reliable performance measure directly related to the updated curriculum.

**Theoretical Framework**

Chinn and Kramer (2011) identify theory as a “creative and rigorous structuring of ideas that project a tentative, purposeful, and systematic view of phenomena” (p. 257). Theory serves to organize concepts and underpins new ways of knowing. Scientific research therefore requires the identification of the theoretical framework that will guide the investigation and serve as a map to organize the construction of knowledge.

Throughout history nursing science has utilized the theories of various disciplines to guide nursing research (Risjord, 2010). Nursing has borrowed theories from disciplines such as psychology, sociology, anthropology, physiology, and pathology to organize ideas and construct new ways of knowing. Oswick, Fleming, and Hanlon (2011) further define theory borrowing as concerned with the “importation of coherent and fully formed ideas that explain a phenomenon…from outside the discipline” (p.319). The use of borrowed theories is helpful to new disciplines that lack a unique and mature knowledge base or in the case of nursing science, when relevant knowledge has already been developed in other disciplines (Gunter, 1962). Research in the simulated clinical environment is a young discipline and currently lacks a distinct theoretical framework unique to nursing (Schiavenato, 2009). Simulation-based nursing
research designs therefore must rely on borrowed theories to maximize evidence while minimizing reductionism.

This study utilized the Teamwork Model as described by Dickinson & McIntyre (1997). The model evolved through the synthesis of several decades of research by organizational psychologists. The borrowed theory serves to define seven core components of teamwork and their relationships with one another (Figure 3).

The purpose of the Teamwork Model (Dickinson & McIntyre, 1997) is to describe the interrelations between essential teamwork processes. The purpose of the TeamSTEPPS® 2.0 TPOT is to provide a quantifiable assessment of team performance through evaluation of interrelations and execution of identified skills employed by the healthcare team during the provision of patient care. The Teamwork Model provides an appropriate theoretical framework to the TeamSTEPPS® 2.0 TPOT as both seek to describe key attributes of the teamwork process.

Dickinson and McIntyre (1997) define teamwork as those collective “behaviors of members that engender a sharing of information and a coordination of activities” (p.30). The teamwork under evaluation in this study was the performance of healthcare providers engaged in a simulated critical patient care event. Specifically, the teamwork was a collective synchronization of individual members whose purpose was to coordinate safe handling of a patient involved in a life-threatening event.

Assumptions

Assumptions are defined as “something being true without formal proof” (Shugan, 2007, p.450). Shugan (2007) further explains assumptions as the “ingredients in a gourmet recipe” (p.457). Without explicitly stating assumptions (the ingredients), research findings (the gourmet
Several assumptions are inherent to the proposed study and must be addressed. Defining assumptions leads to a deeper understanding of research findings.

**Theoretical Assumptions**

A variety of basic truths, or assumptions, underlie the Teamwork Model (Dickinson & McIntyre, 1997). A first assumption being individual members possess the requisite technical skills and knowledge to perform their own tasks. A second assumption is that individual members possess positive attitudes toward the team and its task. A third assumption is that leaders and members focus attention and concern on improving teamwork rather than individual success and performance. A fourth assumption is that individual team members possess a willingness to provide and seek help. A fifth and final assumption is that tasks are interchangeable within the team allowing for backup support to be offered.

**Methodological Assumptions**

Methodological factors must be defined to ensure proper data analysis. Validity assumptions require valid measurements, a reasonable sample, and unconfounded comparisons. Methodological assumptions related to validity measurements of this study include participants possess knowledge of TPOT and TEAM variables and used their knowledge to properly assign scores based on the performance observed.

Validity assumptions related to sampling were that the recorded team performances demonstrate the characteristics of team functioning. Validity assumptions related to comparisons were that data were normally distributed and that the simulation experience provided was equal. In this study the performances demonstrated are not equal but all participants received the same equipment/information. Factor analysis assumptions included errors are random and have a mean
of zero, common factors are assumed to have a variance of one, and common factors are uncorrelated with one another (Pennsylvania State University, 2004).

A reliability assumption was that all participants scored each performance using the scale in a similar manner. For example, a score of 1 is a 1 for the overall performance not for a single instance of poor performance from a singular participant. A second reliability assumption is that a missed variable was scored as 1.

**Nursing Assumptions**

Two assumptions were present from a nursing perspective. A first assumption was that individual nurses possessed the requisite technical skills and knowledge to perform their own tasks when functioning within the healthcare team. For example, in order for a nurse to become a member of the healthcare team, a nursing license is required.

A second nursing assumption was that individual nurses possess positive attitudes toward their role as nurse. As a member of the profession, nurses seek to avoid harming patients. Nurses, by the nature of their work, are motivated to improve performance to ensure patient safety.

**Personal Assumptions**

The first personal assumption was that the TeamSTEPPS® curriculum is an effective teaching strategy for improving healthcare teams. The TeamSTEPPS® program was created as an evidence-based teamwork educational strategy and released to the public in 2006 (King et al., 2013). The TeamSTEPPS® 2.0 TPOT was created to quantify team performance. However, evidence to support the improvement of team performance after TeamSTEPPS® training was lacking.
The second personal assumption was that healthcare requires a team approach. Nursing as a profession would be limited in its ability to improve the health of individuals, families, and communities without other healthcare disciplines. For example, in the hospital environment nurses would be limited in their ability to provide medical care without medications dispensed from the pharmacy. Ambulatory surgery centers, urgent care clinics, and community health agencies are among the various healthcare environments where multidisciplinary teams are involved in patient care. The author of this study acknowledges healthcare providers do not function independently of other disciplines. Therefore, if nursing is to improve care quality, performance of the healthcare team must be explored.

The primary focus of pre-licensure nursing education assessment is at the individual level, and this concept served as the third personal assumption. Performance based assessments are often limited to the individual student while the ability of the student to perform as a member of the healthcare team are seldom addressed and rarely quantified. Licensing examinations do not require team performance assessments; thus new graduates may demonstrate team competency from a cognitive level but lack the ability to function as a member of the healthcare team. Without adequate assessment and quantification, new nursing graduates risk entering practice without requisite team skills. Entering practice without the requisite skills results in frustration for the nurse and increased risk of harm to patients who rely on high-functioning healthcare teams.

A final personal assumption was that study participants reviewed the study-related videos and scored the performance to the best of their ability. Study participants recruited online were not supervised during data collection. It is a personal assumption the scoring of videos was an honest representation of the participants’ impressions of what was observed.
Research Questions

Several questions underlie this research study in an effort to determine baseline psychometric properties of the TeamSTEPPS® 2.0 TPOT.

1. What is the content validity of the TeamSTEPPS® 2.0 TPOT among a sample of TeamSTEPPS® trained individuals?
2. What is the construct validity of the TeamSTEPPS® 2.0 TPOT among a sample of TeamSTEPPS® trained individuals?
3. What is the internal consistency reliability of the TeamSTEPPS® 2.0 TPOT among a sample of TeamSTEPPS® trained individuals?
4. What is the concurrent validity of the TeamSTEPPS® 2.0 TPOT when correlated with TEAM data?
5. What is the test-retest reliability of the TeamSTEPPS® 2.0 TPOT among a sample of TeamSTEPPS® trained individuals?
6. What is the inter rater reliability of the TeamSTEPPS® 2.0 TPOT among a sample of TeamSTEPPS® trained individuals?

Definition of Terms

TeamSTEPPS® 2.0 TPOT Definitions and Relationship to Teamwork Model

Team structure. Team Structure is the first of five key principles measured with the TPOT 2.0 (Agency for Healthcare Research and Quality, 2014). The TeamSTEPPS® curriculum delineates Team Structure fundamentals such as team size, membership, leadership, composition, identification and distribution. The TeamSTEPPS® 2.0 TPOT Team Structure variables are: assembles a team; assigns or identifies team members’ roles and responsibilities; holds team members accountable; and includes patient and families as part of the team.
The Teamwork Model describes team orientation as the attitudes that team members have toward one another (Moe, Dingsoyr, & Dyba, 2010). Team orientation reflects an acceptance of team norms, the level of group cohesiveness and the importance of team membership. Team orientation also includes participating in all relevant aspects of the team. Team orientation of the Teamwork Model and Team Structure share similar attributes.

**Communication.** The second key principle measured with the TeamSTEPPS® 2.0 TPOT is Communication (Agency for Healthcare Research and Quality, 2014). Communication is defined as the process by which information is clearly and accurately exchanged among team members. The TPOT variables related to Communication are: provides brief clear specific and timely information to team members; seeks information from all available sources; uses check-backs to verify information that is communicated; and uses SBAR, call-outs, and handoff techniques to communicate effectively with team members. SBAR is a technique to communicate official information that requires immediate attention and action concerning a patient’s condition. S stands for situation, or what is going on with the patient. B stands for background, or what is the relevant clinical background. A stands for assessment, or what the problem is thought to be. R stands for recommendation, or what can be done to correct the situation. Call-outs are a strategy used to communicate important or critical information by informing team members simultaneously and help team members anticipate the next steps. Check-backs serve as a process of closed-loop communication to ensure information conveyed by the sender is understood by the receiver it is intended. The sender double-checks to ensure that the message was received. Handoff techniques are employed during transitions in care across the patient care continuum and allow the opportunity to ask questions, clarify and confirm information received.
The Teamwork Model addresses communication in a manner similar to the TeamSTEPPS® 2.0 TPOT. According to the Teamwork Model, communication involves the exchange of information between two or more team members in the prescribed manner and using appropriate terminology (Dickinson & McIntyre, 1997). Using communication to clarify or acknowledge the receipt of information is defined in the concept of communication. The processes of verifying, acknowledging, and repeating information to ensure understanding are similarly addressed in the TeamSTEPPS® 2.0 TPOT.

Leadership. Leadership is the third key principle measured by the TeamSTEPPS® 2.0 TPOT (Agency for Healthcare Research and Quality, 2014). The TeamSTEPPS® curriculum defines Leadership as the ability to coordinate the activities of team members by ensuring team actions are understood, changes in information are shared, and that team members have the necessary resources. The TeamSTEPPS® 2.0 TPOT variables related to Leadership are: identifies team goals and vision, uses resources efficiently to maximize team performance, balances workload within the team, delegates tasks or assignments, as appropriate, conducts briefs, huddles and debriefs, and role models teamwork behaviors. Briefs are similar to a flight checklist. Briefs are called by the team leader and serve to prepare the team for the flow of the procedure, contingency plans, and the means for resolving any unusual circumstances. Huddles are ad hoc planning sessions, which serve to reinforce plans already in place and to assess the need to adjust the plan. Debriefs are called once an event has taken place to review what went well and what changes can occur to improve performance.

Team leadership according to the Teamwork Model involves providing direction, structure, and support for other team members (Moe et al., 2010). Team leadership also involves explaining to other team members exactly what is needed from them during an event. Listening
to the concerns of team members is also a necessary attribute of team leadership according to the Teamwork Model. The Teamwork Model identifies feedback as a separate component of teamwork while the elements are imbedded in the Leadership variable of the TeamSTEPPS® 2.0 TPOT. For example, giving feedback to team members is addressed through conducting briefs and empowering members to speak freely and ask questions.

**Situation Monitoring.** The fourth principle measured by the TeamSTEPPS® 2.0 TPOT is Situation Monitoring. TeamSTEPPS® curriculum describes Situation Monitoring as the process of actively scanning and assessing situational elements to gain information, understanding, or maintaining awareness to support functioning of the team (Agency for Healthcare Research and Quality, 2014). The TeamSTEPPS® 2.0 TPOT variables related to Situation Monitoring are: monitors the status of the patient, monitors fellow team members to ensure safety and prevent errors, monitors the environment for safety and availability of resources (e.g., equipment), monitors progress toward the goal and identifies changes that could alter the plan of care, and fosters communication to ensure that team members have a shared mental model. A shared mental model among team members is an idea that team performance improves if team members have a common understanding of the task to be performed and the involved teamwork.

The Teamwork Model defines monitoring as observing the activities and performance of other team members (Moe et al., 2010). Monitoring also involves recognizing when a team member performs correctly. The concept of coordination is described in the Teamwork Model as facilitating the performance of other members’ jobs and passing performance-relevant data to other members in an efficient manner. This dimension of coordination is evident in the Situation Monitoring variable of the TeamSTEPPS® 2.0 TPOT.
Mutual Support. The fifth key team concept evaluated with the TeamSTEPPS® 2.0 TPOT is Mutual Support (Agency for Healthcare Research and Quality, 2014). Mutual Support is the ability to anticipate and support other team members’ needs through accurate knowledge about their responsibilities and workload. The TeamSTEPPS® 2.0 TPOT evaluates the following attributes of Mutual Support: provides task-related support and assistance, provides timely and constructive feedback to team members, effectively advocates for patient safety using the Assertive Statement, Two-Challenge Rule or CUS, uses the Two-Challenge Rule or DESC Script to resolve conflict. The Assertive Statement is a five-step process that is a nonthreatening and respectful way to make sure an individual’s concern or critical information is addressed. The Assertive Statement steps are: open the discussion, state the concern, state the problem, real or perceived, offer a solution, and obtain an agreement. The Two-Challenge Rule calls for the team member being challenged to acknowledge the concern. If the assertion is ignored after two attempts, the concerned team member is instructed to take a stronger course of action or utilize the chain of command to intervene. CUS stands for I’m concerned, I’m uncomfortable, and this is a safety issue. The CUS strategy is one way of employing the Two-Challenge Rule. Again, the team member being challenged is responsible to address the concern. The DESC script is a constructive approach for managing and resolving conflict. D stands for describe the situation or behavior and provide concrete data. E stands for express how the situation makes you feel or what your specific concerns are. S stands for suggest other alternatives and seek agreement. C stands for consequences should be stated in terms of impact on established team goals as well as strives for consensus.

The Teamwork Model uses the term backup to imply behaviors in line with Mutual Support (Moe et al., 2010). Backup includes being available to assist other team members and
implies that members have an understanding of the member’s tasks. Backup also involves filling in for another member who is unable to perform the tasks and helping another member correct a mistake. Mutual Support behaviors are also evident in the Teamwork Model coordination component. Coordination involves the exchange of information that subsequently influences another members’ performance. Mutual Support is similarly addressed in the Teamwork Model.

Theoretical Concepts

Seven core concepts of teamwork are addressed in the Dickinson and McIntyre (1997) framework. Communication is the major component of the teamwork process and links other components of the model. Team orientation and team leadership comprise the second and third critical concepts. Monitoring serves as the fourth component of team performance. The fifth concept of teamwork in the Dickinson and McIntyre (1997) model is feedback. Backup and coordination serve as the sixth and seventh core components of the model. The concepts of the Teamwork Model are quantitative in nature and possess minimal abstraction allowing for empirical investigation of the phenomenon.

Theoretical Concepts Defined

Communication. Communication is a key element of the Teamwork Model and the first core component of teamwork addressed. Communication is defined as the “active exchange of information between two or more members of the team, as well as an individual team member providing information to others in the appropriate manner” (Dickinson & McIntyre, 1997, p.32). Communication is also used to “clarify or acknowledge the receipt of information” (Dickinson & McIntyre, 1997, p.25). Dickinson and McIntyre (1997) do not distinguish between verbal and non-verbal communication though an active exchange and acknowledgement to the receipt of information implies communication can be observed and therefore measured.
**Team Orientation.** Dickinson and McIntyre (1997) define team orientation as the nature of attitudes team members have toward one another, the team task, team leadership, self-awareness as a team member, and group cohesiveness. The assessment of attitudes by an outside observer is difficult to measure (Dierdorff & Ellington, 2012) resulting in an abstract dimension to the concept of team orientation.

**Team Leadership.** Team leadership is described as the direction and structure provided by formal leaders as well as by other members. “Team leadership implies that planning and organizing activities have enabled members to respond as a function of the behaviors of others” (Dickinson & McIntyre, 1997, p.21). The definition of team leadership in the Teamwork Model acknowledges the behavior of both formal and informal leaders to plan and organize a group to function as a cohesive unit. The nature of team leadership as described by Dickinson and McIntyre (1997) is a concrete concept that is observable and measurable.

**Monitoring.** Monitoring is a crucial component of the Teamwork Model (Dickinson & McIntyre, 1997). Monitoring refers to the “observation and awareness of activities and performance of other team members” (Dickinson & McIntyre, 1997, p.22). The concept of monitoring implies team members not only have an understanding of their own task but an understanding of the tasks of other team members. Monitoring can be overt or covert in nature resulting in an abstract dimension for the concept, which can be difficult to be observed and measured by an outsider.

**Feedback.** Feedback is defined as, “the giving, seeking and receiving of information among team members” (Dickinson & McIntyre, 1997, p.22). Feedback allows a team to adapt and learn from their performance. The active transfer of information through feedback is a concrete concept.
**Backup.** Backup behavior involves team members actually helping other team members to perform their task (Dickinson & McIntyre, 1997). The ability of a team to provide backup behavior requires individual members to have the knowledge and ability of other team members tasks. Providing assistance from one team member to another is a concrete concept and can be observed.

**Coordination.** Coordination is the final component of the Teamwork Model (Dickinson & McIntyre, 1997). The concept of coordination “reflects the execution of team activities such that members respond as a function of the behavior of others” (Dickinson & McIntyre, 1997, p.22). Successful coordination of a team depends upon the effective operation of other teamwork principles such as communication, monitoring, and backup (Dickinson & McIntyre, 1997).

Overall, the concept definitions within the Teamwork Model reflect separate ideas and constructs. The concepts as defined within the Teamwork Model align with common convention of similar ideas resulting in a theoretical construct that can be utilized among a variety of teams. Healthcare teams, sports teams, manufacturing plants, and business organizations can utilize the Teamwork Model to understand and refine team performance. Theoretical concepts of the Teamwork Model provide logical structure to the phenomenon of teamwork.

**Relationships of Concepts Within the Theory**

The Teamwork Model provides relationships to the theory through linkages among and between concepts (Dickinson & McIntyre, 1997). Communication influences the process of teamwork during all phases of the model (Figure 3). Team orientation and team leadership are linked together to influence the monitoring of team performance. Monitoring stands alone and is influenced by feedback and backup while also having a direct influence on coordination.
Feedback and backup are linked together to influence coordination. Team orientation and team leadership are linked with coordination to create a learning loop. The Teamwork Model assumes a progressive approach to teamwork with multiple concepts working in concert with one another.

**Theoretical Structure**


**Teamwork Model and the TeamSTEPPS® 2.0 TPOT**

The structure of the Dickinson and McIntyre (1997) Teamwork Model aligns with concepts evaluated by the TeamSTEPPS® 2.0 TPOT. Figure 4 depicts how the study design and TeamSTEPPS® 2.0 TPOT items fit within the model. The research study was structured by an input, throughput, and output format. The input of the study was a pre-recorded scenario depicting a simulated critical patient care event that required a team of care providers to assemble. The throughput of the scenario included the provision of patient care during the simulation. The output of the scenario was the coordination of team activities resulting in a TeamSTEPPS® 2.0 TPOT score.
The seven concepts of the Teamwork Model (Dickinson & McIntyre, 1997) are addressed in the TeamSTEPPS® 2.0 TPOT. Figure 4 illustrates how each item of the TeamSTEPPS® 2.0 TPOT were placed within the Teamwork Model. The list below describes how each of the 23 TeamSTEPPS® 2.0 TPOT elements fit within the Teamwork Model. (The number and letter listed below correspond with the element’s assignment in the TeamSTEPPS® 2.0 TPOT.)

**Communication**

2a. Provides brief, clear, specific, and timely information to team members

2b. Seeks information from all available sources

2c. Uses check-backs to verify information that is communicated

2d. Uses SBAR, call-outs, and handoff techniques to communicate effectively with team members

5d. Uses the Two-Challenge Rule or DESC Script to resolve conflict

**Team Orientation**

1a. Assembles a team

1d. Includes patients and families as part of the team

5c. Effectively advocates for patient safety using the Assertive Statement, Two-Challenge Rule, or CUS

**Team Leadership**

1b. Assigns or identifies team members’ roles and responsibilities

1c. Holds team members accountable

3a. Identifies team goals and vision

3b. Uses resources efficiently to maximize team performance
3d. Delegates tasks or assignments, as appropriate

3f. Role models teamwork behaviors

**Monitoring**

4a. Monitors the status of the patient

4c. Monitors the environment for safety and availability of resources (e.g., equipment)

4d. Monitors progress toward goal and identifies changes that could alter the plan of care

**Feedback**

4e. Fosters communication to ensure that team members have a shared mental model

5b. Provides timely and constructive feedback to team members

**Backup**

3c. Balances workload within the team

5a. Provides task-related support and assistance

**Coordination**

3e. Conducts briefs, huddles, and debriefs

4b. Monitors fellow team members to ensure safety and prevent errors

The Dickinson and McIntyre (1997) Teamwork Model served as the theoretical framework for the study. The framework helped to ensure scientific rigor of the study by explicitly defining teamwork concepts and the nature of relationships within the model.

Establishing the definition of teamwork concepts and the relationship of the theoretical constructs provided a foundation for exploring the psychometric properties of the TeamSTEPPS® 2.0 TPOT instrument.
**Teamwork Model and TeamSTEPPS® 2.0 TPOT Relationships**

The concepts of the Teamwork Model and the concepts of the TeamSTEPPS® 2.0 TPOT are closely related. Five of seven Teamwork Model concepts correspond directly to the TeamSTEPPS® 2.0 TPOT. While coordination and feedback are not explicitly addressed in the TeamSTEPPS® principles, the concepts are embedded throughout the TeamSTEPPS® 2.0 TPOT subscales.

**Limitations**

The potential for study limitations were present within the study. The study limitations arose from the sampling technique, the study design, and transferability of the study findings. Each limitation is defined and strategies for overcoming the limitations are examined below.

**Sampling**

The study relied on convenient expert sampling, exponential discriminative snowball sampling technique, and face-to-face recruitment of newly trained TeamSTEPPS® individuals. Fifty-one study participants who had participated in TeamSTEPPS® training were recruited. Initial recruitment occurred through professional contacts. When fifty professional contacts did not complete data collection, the use of the snowball sampling technique was employed which possessed inherent limitations. First, the researcher relied on the participants’ personal identification of TeamSTEPPS® familiarity. Demographic information attempted to confirm individuals had undergone TeamSTEPPS® training, verification of the participants’ knowledge of TeamSTEPPS® concepts was difficult to ascertain without pre-screening knowledge before inclusion. Pre-screening did not occur prior to participant enrollment due to a limited access to TeamSTEPPS® trained individuals. Self-reported familiarity of the TeamSTEPPS® program was however obtained in an effort to overcome this limitation.
Second, representativeness of the sample could not be confirmed. The true distribution of the population was difficult to ascertain. The exact number of TeamSTEPPS® trained individuals is unknown due to several training methods available (Powell, 2014). Therefore, it is unknown how representative study participants were to the true population. A demographic questionnaire attempted to overcome this potential limitation by determining the participants’ year of TeamSTEPPS® training completed.

Third, sampling bias may have resulted from the use of the snowball sampling technique and face-to-face recruitment. Relying on participants to recruit other study participants resulted in a sample that was limited in experience and location. The snowball sampling technique did however, overcome the limitation of one researcher recruiting all study participants.

**Design**

The overall study design possessed limitations. In order to establish psychometric properties of the TeamSTEPPS® 2.0 TPOT, the lowest number of participants to establish power was sought. Smaller sample sizes impact the statistical power of a study. A small sample size also reduced the likelihood that a statistically significant result reflected a true effect (Button et al., 2013). The consequence of this limitation is a low reproducibility of results.

The small sample size also meant participants had to view several videos. Mental fatigue may have resulted after viewing multiple videos, which may have impacted study findings. The fatigue may have caused distraction to participants and may have influenced participants’ sensitivity to evaluating the team performance (Brehman, Burns, Thaler, Rojas, & Barchard, 2009). The reviewing and scoring of five performances required approximately sixty minutes. Participants were notified of the expected time commitment prior to the data collection session in an attempt to overcome the potential for mental fatigue.
One researcher was responsible for all data collection related to the study. This meant the researcher was required to recruit all study participants. The snowball sampling technique attempted to overcome this potential limitation because TeamSTEPPS® trained healthcare professionals unknown to the researcher were identified.

The manner in which data were collected was another limitation. Data collection occurred through online video review and online survey system of TeamSTEPPS® 2.0 TPOT and TEAM scoring for individual participants. The researcher was not present during online data collection thus outside distractions to study participants could not be controlled. Online participants were advised to minimize distractions during online video review and scoring though this variable could not be controlled. Face-to-face interactions occurred for group video review and paper scoring. Participants were instructed at the beginning of data collection to avoid verbal and non-verbal communication with each other. Data collection among group sessions may have been threatened due to the influence of reviewing and completing performance scoring in the presence of others.

**Delimitations**

**Generalizability**

The generalizability of research findings to all healthcare teams was a delimitation of the study. The team performance video recordings used in the study did not represent all possible healthcare teams. Because of this limitation several members of the healthcare team were excluded from study. For example, operating room teams and outpatient medical teams were not included in the evaluation of team performance for this study. Study findings suggest the psychometric properties of the TeamSTEPPS® 2.0 TPOT for use in the evaluation of healthcare teams; direct understanding of healthcare teams in various settings must be assumed.
Transferability of the TeamSTEPPS® 2.0 TPOT from the simulated clinical environment to direct patient care will also have to be assumed.

**Summary**

This chapter introduced a study that explored the psychometric properties of the TeamSTEPPS® 2.0 TPOT. A case for the study was established based on the significance of the study to nursing practice, nursing education, nursing research, and healthcare. The Dickinson & McIntyre Teamwork Model provided the theoretical structure to the study. The study assumptions were identified from a theoretical, methodological, nursing, and personal perspective. Explicit research questions related to the study were described. Conceptual definitions and measurable variables were operationally defined. Finally, study limitations and delimitations were identified.
Chapter Two
Review of Literature

This chapter provides an overview of what is and is not known regarding team science and healthcare team training. A variety of methods to explore team training and theoretical constructs related to team science will be explored. The Dickinson and McIntyre Teamwork Model is further described and an explanation provided regarding how integration of the model supports psychometric testing of the TPOT. Evidence for the need of this theory-linked study is established.

What is Known

The literature is replete with studies related to the science of teams. Several authors have provided definitions of what a team is (Boguslaw & Porter, 1962; Briggs & Naylor, 1964; Hall & Rizzo, 1975; Morgan, Glickman, Woodard, Blaiwes, & Salas, 1986). Dyer (1984) describes teams as social entities composed of members with high task interdependence and shared, valued, common goals. Teams are usually hierarchically organized so that the leader holds the most power and may be dispersed geographically (Salas, Cooke, & Rosen, 2008). Teams must integrate, synthesize, and share information (Salas et al., 2008). In order to accomplish their mission, teams must coordinate and cooperate as task demands shift throughout the performance. During a performance two distinct processes occur: taskwork and teamwork. Taskwork is defined as “the components of a team member’s performance that do not require interdependent interaction with other team members” (Salas et al., 2008, p.541). Teamwork is defined “as the interdependent components of performance required to effectively coordinate the performance of multiple individuals” (Salas et al., 2008, p.541).
**Team Science.** The crux of teamwork is for team members to “use a collection of processes, strategies and actions that allow them to effectively and efficiently perform” (Stout, Salas, & Fowlkes, 1997, p.170). Knowledge, skills, and attitudes (KSAs) are the collection of competencies team members must possess to ensure adequate teamwork. Stout, Salas, and Fowlkes (1997) specify knowledge as the information the team members “need to possess to execute their team tasks and include an understanding of team member roles and responsibilities” (p.170). Skill competencies are “what enable team members to actually carry out required functions and actions” (Stout, Salas, & Fowlkes, 1997, p.170). Eight skill dimensions have been identified which underlie the teamwork construct. The teamwork skill dimensions are: adaptability, situational awareness, performance monitoring and feedback, leadership and team management, interpersonal relations, coordination, communication and decision making (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995). Attitude competencies are the “beliefs that team members have about performing team tasks and include attitudes towards teamwork, collective orientation, collective efficacy, and cohesion” (Stout, Salas, & Fowlkes, 1997, p.170). It is the collective presence and deployment of KSAs among the team during a performance that ensures the quality of teamwork.

**Teamwork and patient outcomes.** Empirical evidence exists which supports a positive relationship between teamwork and patient outcomes. Shorter hospital stays have resulted from improved teamwork strategies. One hospital described a decrease from 11-inpatient days post liver transplant to 8-inpatient days after improving communication among the healthcare team (Toledo et al., 2013). A 900-bed hospital reported a reduction in length of stay from 8.56 days to 7.93 days after implementing improved coordination among the medical team (Ortiga et al., 2012).
Multiple authors have described a positive correlation between patient safety and team performance. Risser and colleagues (1999) performed a retrospective study of Emergency Department malpractice incidents. Fifty-four incidents were identified and judged preventable by better teamwork. An average of 8.8 teamwork failures occurred per case. More than half of the deaths and permanent disabilities that occurred were judged avoidable (Risser et al., 1999). Boston Children’s Hospital decreased PAEs from 3.3 per 100 admissions to 1.5 per 100 admissions after improving provider-to-provider handoff communication (PR Newswire, 2013). Improved team performance can reduce medical errors.

Improved team performance not only results in improved delivery of care through shorter hospital stays and fewer adverse events, improved teamwork also positively influences patient experiences with the healthcare team. Patient satisfaction rates are high when coordination exists between healthcare providers (Gittell, 2002). In a study of postsurgical care in nine hospitals Gittell (2002) reported strong provider-provider relationships directly increased customer satisfaction and loyalty (.24, $p < .001$). The author suggested this was because the overall service experience was more effectively coordinated. One surgical intensive care unit reported satisfaction scores for family participation in decision making to improve from 45% to 68% and recognition of the health care team working together from 64% to 83% after implementing a communication algorithm among healthcare team members (Huffines et al., 2013).

Reduced postoperative pain has also been reported when strong healthcare team strategies are in place (Gittell et al., 2000). Gittell and colleagues (2000) identified postoperative freedom from pain was associated with an overall index of team performance as measured by four dimensions: frequency of communication, shared goals, shared knowledge, and mutual
respect. The dimensions provide an overall index of relational coordination and postoperative freedom from pain (linear regression coefficient 10.915, P-0.041).

**Simulation and team training.** In order for healthcare teams to improve the quality of care provided, the opportunity to improve KSAs via training must be available to team members. The simulated clinical environment provides an ideal setting for training and evaluating healthcare teams (Rutherford-Hemming, 2012). Simulated learning opportunities that integrate feedback, debriefing or guided reflection support a link between theory and practice, as well as increase learners’ ability to synthesize knowledge (Decker, Sportsman, Puetz, & Billings, 2008; Bruce, Bridges & Holcomb, 2003).

The characteristics of clinical simulation have been well described. Several studies acknowledge the value of the simulated clinical environment to provide an opportunity for the rehearsal of team strategies (Weller, 2004; Marshall & Flannagan, 2010; Paskins & Peile, 2010). Both medicine and nursing describe best practices for training healthcare providers through simulated learning opportunities. In 2005, the Best Evidence in Medical Education collaboration published a systematic review of the features of teaching using simulators that lead to effective learning (Issenberg, McGahie, Petrusa, Gordon, & Scalese, 2005). The ten key features identified were: feedback, allowing learners to engage in repetitive practice, integration onto the curriculum, allowing learners to practice with increasing levels of difficulty, ability to adapt to multiple learning strategies, clinical variation, a controlled environment, individualized learning, having clear outcomes and simulator validity. Bremner and colleagues (2006) identified best practices of utilizing clinical simulation instruction with novice nursing students. The best practices included: well articulated learner outcomes of each session, clear connection to course/clinical objectives, ongoing training and supervision of faculty, staff and participation/
collaboration with students and faculty in the planning, implementation, evaluation of each session. Debriefing sessions should also occur after each simulation experience. Simulation based team training has proven a powerful training methodology because it allows teams an opportunity to participate in dynamic social, cognitive and behavioral processes of teamwork as well as receive feedback and remediation based on team performance (Gorman et al., 2007).

The training of healthcare teams in a simulated clinical environment alone does not ensure teamwork competencies will be developed. Team training opportunities must include the evaluation of trainees’ reactions to the learning experience as well as measures of procedural learning, assessment of competence through formative assessments, and evaluation of performance in the practice setting (Weaver, Rosen, Salas, Baum, & Kings, 2010). The purpose of evaluation is threefold. First, team performance evaluation provides a mechanism to guide learning through systematic, developmental feedback (Salas, Rosen, Burke, Nicholson, & Howes, 2007; Cannon-Bowers et al, 1995). Second, team performance evaluation enables summative assessment by providing an evaluation of the team’s development to trainers and team members at a particular time (Rosen et al., 2010). Third, by determining behavioral and outcome criteria, evaluation provides a means to validate team training (Magee, 2003). Healthcare team training must therefore include evaluation to provide measurable outcomes in an effort to gauge success of the program and to explore areas of improvement.

The evaluation of team performance is a necessary component of team training yet difficult to accomplish. The challenges of team performance measurement relate to the dynamic nature of teams. Teams are composed of individual members with heterogeneous knowledge, skills and attitudes working together to achieve a shared goal (Baker, Salas, Barach, Battles, & King, 2007). Team performance outcomes are thereby a synergistic product of multiple inputs.
In order to comprehensively evaluate the team performance, measures that capture the behavioral, cognitive, and attitudinal components of the performance must be utilized (Salas, Wilson, Murphy, King, & Salisbury, 2008). This also includes capturing individual team member roles in order to provide targeted corrective feedback. In summary, the evaluation tool used to evaluate team performance should include assessment of the KSAs underlying effective teamwork.

Validated team instruments. Several evaluation tools have been designed in an effort to quantify team performance. Four instruments frequently used to assess team performance are discussed. The Anesthesia Non-Technical Skills (ANTS) System, the Observational Teamwork Assessment of Surgery (OTAS), the Clinical Teamwork Scale (CTS), and the Team Emergency Assessment Measure (TEAM) are observation-based team performance evaluation tools. Each is described in greater detail below.

ANTS. The ANTS System was developed through collaboration between industrial psychologists and anesthetists in Scotland (Fletcher, et al., 2003). The purpose of the ANTS System is to develop a taxonomy for structured observations of anesthesia teams. The ANTS System is designed as a hierarchy with four higher-level skill categories (task management, team working, situation awareness, and decision making). Fifteen lower level skill elements exist within the four dimensions. Each element has a definition and sample behavior markers are scored using a four-point scale to describe the overall performance (1-Poor, 2-Marginal, 3-Acceptable, 4-Good). The ANTS System has been empirically tested with acceptable levels of face and content validity reported (Fletcher et al., 2003). Internal consistency reliability has been reported with Cronbach α ranging from 0.79-0.86 (Fletcher et al., 2003). Anesthetists designed
the ANTS system for use in the operating room and has not been widely used outside this practice setting for analysis of team performance.

**OTAS.** A second instrument used in the evaluation of team performance is the OTAS. This instrument was also developed to evaluate technical and interpersonal skills among surgical teams. The OTAS is concerned with the evaluation of taskwork and teamwork across three distinct surgical stages: pre-operative, intra-operative, and post-operative (Undre, Sevdalis, Healey, Darzi, & Vincent, 2007). The three tasks evaluated are: patient tasks related to actions or information associated directly with the patient, equipment and provision tasks to include checking and counting surgical instruments, and communication tasks to include confirming consent, patient details and operative site. Five teamwork-related behaviors are rated on seven-point scales, which include communication, coordination, cooperation/backup behaviors, leadership, and monitoring/awareness. Separate ratings are provided for each of the teamwork behaviors among three operating room subteams (nurses, surgeons, anesthetists). Content validity of the instrument has been reported with a Cohen’s $\kappa > 0.41$ for 83.85% of exemplar behaviors (Hull, Arora, Kassab, Kneebone, & Sevdalis, 2010). Undre and colleagues (2007) described inter rater reliability of the OTAS with Pearson correlation coefficients ($r$) between behavior ratings of two observers $> 0.50$ for all behaviors except communication ($r = 0.35$). Similar to the ANTS, the OTAS has not been widely used to evaluate team performance outside of the perioperative setting.

**CTS.** The CTS is an instrument to objectively evaluate teamwork during short clinical team simulations as well as everyday clinical care (Guise et al., 2008). The CTS is a 15-item instrument based on five conceptual teamwork domains. The teamwork domains are: communication, situational awareness/resource management, decision-making, role
responsibility, and patient-friendliness. The instrument is scored on a 0-10 scale with 0 being unacceptable and 10 being perfect. Construct validity was established by three raters scoring three different scenarios based upon a predetermined teamwork level (poor, average, perfect teamwork). Twelve of fifteen items had 100% accurate rating, and three items had accuracies of 66.7% to 88.9%. Interrater reliability was established with Pearson correlation coefficient between 0.94 and 0.96 for overall scores among raters (Guise et al., 2008). The CTS is different from the ANTS and OTAS because it can be used in any clinical environments where teamwork is essential.

**TEAM.** The TEAM instrument was developed to provide a reliable and feasible teamwork assessment measure for emergency resuscitation team performance (Cooper et al., 2010). The instrument consists of 12-items designed as a teamwork observational scale. Three subscales are identified to assess leadership, teamwork, and task management. Eleven items are scored on a 4-point scale with 0 meaning never/hardly ever observed to 4 meaning always/nearly always observed. The twelfth item serves as a global rating indicator of the performance scored on a 10-point scale. Cooper and colleagues (2010) report significant validity and reliability assessment of the TEAM instrument. Authors report content validity index (CVI) of greater than 0.83 on all items and a total item content validity of 0.96 (Cooper et al., 2010). A 56 video-recorded resuscitation team review by one researcher yielded an alpha coefficient of 0.97. Follow up analysis of rating by three resuscitation instructors during ‘real time’ testing produced an alpha coefficient of 0.97 (Cooper & Cant, 2014). Studies among pre-licensure and practicing nurses have utilized the TEAM instrument to measure non-technical skills of medical teams during patient care emergencies (Cooper & Cant, 2014).
Psychometric testing of the TPOT provided a perspective unique from the validated team instruments previously reviewed. The validated instruments reviewed were designed for specific practice settings. The TPOT however was created directly from the TeamSTEPPS® curriculum and transferrable to all healthcare teams. Since the TeamSTEPPS® program seeks to strengthen team function among medical teams, the TPOT has greater utility among multidisciplinary teams regardless of specialty or setting. Several instruments have been created and tested to objectify team performance however, a great deal is unknown regarding the TPOT and the transferability of the TeamSTEPPS® program to improved patient outcomes.

**What is Not Known**

The ultimate goal of nursing research is to “develop, refine, and expand knowledge” (Polit & Beck, 2012, p.3). In order to expand nursing knowledge, gaps in knowledge must be explored. While a great deal of knowledge exists in terms of team science, strategies to improve patient safety, the value of the simulated patient care environment, and the existence of validated instruments to objectify team performance, a great deal of information related to the study remains unknown. Little is known about the impact of team training on nursing students’ ability to perform as members of the healthcare team. Additionally, psychometric properties of the TPOT among nursing students is extremely limited. Finally, the effectiveness of TeamSTEPPS® training over time has not been established.

**Impact of team training on nursing students.** The importance of team training to improve healthcare quality is well established. The American Association of Colleges of Nursing, National League for Nursing, and National Council of State Boards of Nursing value the importance of a nursing workforce that can work effectively in team environments. Nevertheless, the opportunities for team training are seldom offered in nursing education
curricula (Husebo, Rystedt, & Friberg, 2011). Should the opportunity for team training in nursing education occur, the influence of the training on students’ ability to perform as effective members of the team is rarely measured.

Objectifying nursing students’ performance has proven to be a challenge. Rigorous, valid, and reliable evaluations are difficult to achieve yet essential to ensure readiness for practice (Cant, McKenna, & Cooper, 2013). No clear consensus exists among nurse educators about how performance measures of nursing students can best be achieved. While schools of nursing struggle to quantify individual students’ performance, the ability of the student to perform in a team environment is seldom, if ever, formally evaluated.

The lack of team evaluation in nursing education most likely occurs for several reasons. First, the opportunity for team training occurs infrequently. Second, providing valid and reliable assessment of the team performance can be difficult to achieve. Third, with the infrequency of team training opportunities and the challenge of providing valid and reliable assessment of team performance, a challenge exists for educators to make sense of team performance measures. Are team experiences and evaluations formative or summative learning opportunities? Are consequences such as grades or course progression attached to the evaluation? The myriad layers of complexity result in a lack of knowledge regarding the effectiveness of team training upon nursing students’ ability to perform as members of the healthcare team.

Psychometric properties of the TPOT. In 2006, the AHRQ released the TeamSTEPPS® curriculum. An updated curriculum was made available in 2014, which streamlined course delivery and included additional implementation modules related to coaching, action planning, and change management (Powell, 2014). Three team-related instruments are included in the curriculum. The instruments are the Teamwork Attitudes Questionnaire (T-
TAQ), the Teamwork Perceptions Questionnaire (T-TPQ), and the Team Performance Observation Tool (TPOT). The resources are available free of charge to support evaluation of individual attitudes related to teamwork in healthcare (T-TAQ), evaluation of an organization’s cultural affinity toward teamwork (T-TPQ), and the quantification of team members’ abilities to perform in a team environment (TPOT). Psychometric properties of the T-TAQ and T-TPQ are available (American Institutes for Research, 2010). An exhaustive search of the literature reveals that the psychometric properties of the TPOT have been underreported.

The purpose of the T-TAQ is to measure individual participants’ attitudes toward the core components of teamwork in healthcare. The T-TAQ has been updated in the TeamSTEPPS® 2.0 curriculum. The T-TAQ was a 25-item instrument and is now a 30-item instrument that evaluates five core team competencies: team structure, leadership, mutual support, situation monitoring, and communication using a 5-point Likert scale. Baker and colleagues (2010) described psychometric testing of the first T-TAQ version. The authors reported scale reliabilities that exceeded 0.7 and found the T-TAQ to be a “useful, reliable and valid tool for assessing individual attitudes related to the role of teamwork in the delivery of healthcare” (Baker, Amodeo, Krokos, Slonim, & Herrera, 2010, p. 1). The instrument can be administered as a stand-alone assessment or to evaluate changes in team attitudes over time. Maguire, Bremner, and VanBrackle (2014) described significant gains in T-TAQ version 1.0 scores among a cohort of undergraduate nursing students after repeated exposure to TeamSTEPPS® concepts were embedded in simulation activities across a curriculum.

The T-TPQ is the second instrument available from the TeamSTEPPS® curriculum to measure teamwork. The purpose of the T-TPQ is to measure individuals’ perception of group-level team skills and behavior within an organization by way of self-report and was not modified
in the TeamSTEPPS® 2.0 curriculum release. The T-TPQ is a 35-item questionnaire measuring seven individual items for each of the five TeamSTEPPS® constructs: team structure, leadership, mutual support, situation monitoring, and communication. Cronbach’s alpha reliability coefficients ranged from 0.88 to 0.95 (American Institutes for Research, 2010). Follow up analysis of the T-TPQ found the instrument to possess strong construct validity and to be more reliable than previously thought with Cronbach’s alpha coefficient = 0.978 (Keebler et al., 2014). The T-TPQ can be used by healthcare settings to evaluate the perceptions of teamwork within the organization.

While the TeamSTEPPS® curriculum provides various assessment instruments, two of the three tools measure attitudes and inherently, attitude scales are of limited validity. Attitude scales do not predict behavior very well. Printed words on a page bear little resemblance to actual situations that are complex and multidimensional (UC Davis, 2014). Attitude scales can serve as supporting evidence to the effectiveness of team training when paired with performance measures. Establishing psychometric properties of the TPOT is therefore necessary to provide organizations with a valid and reliable instrument to move beyond the individual and organizational attitude of team to a more accurate assessment of how teamwork is performed within the organization.

**Effectiveness of TeamSTEPPS® training.** Initial development of the TeamSTEPPS® curriculum began in 2004 (King et al., 2013). Widespread dissemination of the program began in 2006. Since its inception, thousands of healthcare providers have been trained on the curriculum. A variety of practice settings such as primary care clinics, acute care institutions, long-term care facilities, medical, dental, and nursing schools have provided TeamSTEPPS® training (Agency for Healthcare Research and Quality, 2014). Training has occurred
internationally and TeamSTEPPS® materials have been translated into French, Spanish, Mandarin and Dutch languages. The TeamSTEPPS® curriculum is believed to be the “largest team training program to healthcare providers in the world” (Baker, 2014). To date, a meta-analysis has not been reported that links TeamSTEPPS® curriculum integration with patient outcomes. Several single-site case studies have been reported documenting the process of TeamSTEPPS® training (Agency for Healthcare Research and Quality, 2014).

In summary, establishing psychometric properties of the TPOT is important for many reasons. Evaluating validity and reliability of the TeamSTEPPS® 2.0 TPOT advances the study of team science by describing an instrument that can be used across disciplines and practice settings to quantify team performance. Psychometric testing of the TPOT in a simulated clinical environment further supports the use of the simulation pedagogy for training and quantification of team skills. The TeamSTEPPS® curriculum is strengthened through evidence of a valid and reliable instrument to complement the attitude and perception measures currently available. Finally, nurse educators have evidence of an instrument to provide formative and summative assessment of student team performance that can be used in any practice setting where team function is essential.

Methods and Theoretical Frameworks Previously Used

Teamwork has been extensively studied over the last 30 years. A variety of methods and theoretical frameworks have been used to explore team training in healthcare. The following review examines current methods used to study team training from a pre-licensure and practice perspective. The various practice settings that employ healthcare team training are discussed along with the teamwork performance measures commonly used. Finally, the theoretical frameworks used to explore team training are reviewed.
**Team training participants.** A review of recent literature regarding team training can be examined from a pre-licensure and practice perspective (Appendix A). The majority of studies utilize a descriptive/exploratory approach situated in a simulated patient care environment (Ericson, Masiello, & Bolinder, 2012; Liaw, Zhou, Lau, Siau, & Chan, 2014; Pelling, Halen, Hammar, & Wahlstrom, 2011; Klipfel et al., 2014; Peckler, Prewett, Campbell, & Brannick, 2012). Participants involved in team training are often interdisciplinary to include: nursing students, registered nurses, advance practice nurses, medical students, residents, physicians, surgeons, anesthetists, physical therapists, occupational therapists, and respiratory therapists. Sample sizes range from small, single-site (23 participants) to large, multi-site studies (105 facilities).

Several studies describe participants’ attitudes regarding the training experience and the impression of the impact of team training on one’s interprofessional knowledge. Ericson and colleagues (2012) evaluated nursing, medicine, and physical therapy students’ perceptions of their own roles before and after team training. The Kruskal-Wallis analysis showed differences between before and after training were significant for all three student categories $\chi^2 (df = 2, N = 221) = 15.33, p < .001$ (Ericson et al., 2012). Team training was also effective in improving the knowledge and understanding students had toward other professions. Wilcoxon signed-ranked test revealed statistically significant increase in nursing students’ perceptions about the role of doctors ($z = -7.42, N\text{-ties} = 71, p < .001$) as well as that of the role of physical therapists ($z = -7.73, N\text{-ties} = 78, p < .001$) (Ericson et al., 2012). A study by Liaw and colleagues (2014) reported both medicine and nursing group paired t-test analysis demonstrated significant improvement in test scores for self-confidence ($p < .001$) and perception ($p < .001$) after participating in simulation based team training. Utilizing the Mayo High Performance
Teamwork Scale and colleagues (2014) evaluated registered nurses and urology residents’ perceptions of team performance before and after clinical simulation. Participants reported an increase in perceived teamwork after training related to communication, situation awareness, and the ability of the team to avoid error or ask for clarification. Scores increased by .7 (on a 1-3 scale) (Klipfel et al., 2014). This review suggests team training yields positive results in both pre-licensed and licensed providers.

**Team training practice setting.** The delivery of healthcare occurs via a team approach across disciplines and for this reason a variety of practice settings are involved in team training. High-acuity, high-risk specialties employ team training to improve performance and quality of care. Appendix A highlights several studies of team training across several high-risk specialties. The specialties reviewed include obstetrics, emergency medicine, pediatric intensive care, and rapid response teams. Randomized-controlled studies were difficult to find (Crofts et al., 2013) possibly due to the complexity of design and intensive nature of such study.

The majority of studies reviewed were single-site. Hughes, Anderson, Patterson, & O’Prey (2014) describe a qualitative analysis of midwifery students’ self-confidence and teamwork at one university. A longitudinal analysis of multidisciplinary health care professionals working in a pediatric intensive care unit find 72.7% of participants felt more confident and 32.5% of study participants were highly confident to attend a future critical event after participating in team training (Stocker et al., 2012).

From a longitudinal, stepwise perspective, a significant ($p < .05$) increase in confidence was reported on a total of 90.9% of questions related to non-technical skills among nurses, cardiologists, intensivists, anesthesiologists, surgeons, and allied health professionals at one healthcare facility after participation in team training (Stocker et al., 2012). Figueroa and colleagues
(2013) conducted surveys before, immediately after and three months after team training to evaluate knowledge and confidence of thirty-seven study participants. Twenty-three of the participants were nurses, five were cardiology/critical care residents, five were respiratory therapists, and four were non-categorized individuals. Participants reported significant increases in confidence among the skills of team leader, advanced airway management, and cardioversion/defibrillation ($p < .05$) (Figuero et al., 2013).

Only one study explored the impact of team training on knowledge, perceptions, and performance (Kilday, Spiva, Barnett, Parker, & Hart, 2013), which provide a more comprehensive assessment of the effectiveness of team training. Kilday and colleagues (2013) conducted a quasi-experimental, pre-post test design and a simulation observation to determine the effectiveness of a combined team training program on neonatal rapid response teams. The perceived teamwork and safety culture, perceived emergency teamwork during resuscitation, knowledge level and team performance were assessed. The perceived emergency teamwork during resuscitation was significantly higher post-training compared with pre-training $t(26) = -4.54$, $p = .000$. Not only did team perception scores increase, there was a statistically significant increase in knowledge scores post-training compared to pre-training, $t(26) = -3.86$, $p = .001$. Team performance was significantly higher post-training (median = 93, $z = -3.05$, $p = .002$, effect size, = -.84) was statistically higher post-training compared with pre-training (median = 75).

The studies reviewed demonstrated a positive training experience reported by participants. The finding suggests healthcare team members value team training. All studies sought to evaluate the effectiveness of team training and advance team science in the practice setting.
Theoretical frameworks. A review of the literature regarding team research revealed more than 130 models and frameworks of team performance or some component thereof (Salas et al., 2008). Several theoretical frameworks have been employed to guide the study of healthcare teams. Four theoretical frameworks are reviewed as they relate to the design of healthcare team research.

Kirkpatrick Four-Level Model of Evaluation. A commonly employed theoretical framework used in the study of healthcare teams is Kirkpatrick’s four-level model of evaluation (Kirkpatrick, 1959). The TPOT was reportedly designed based upon this model (King et al., 2013). The Kirkpatrick model is often used because it is perhaps the best-known evaluation methodology for judging learning processes. The use of the Kirkpatrick model is appropriate as a great deal of team science is concerned with the process of improvement through learning activities.

While most people refer to the four criteria for evaluation of learning processes as “levels” Kirkpatrick calls them “steps” (Craig, 1996). The first step is reaction: how well did the learners like the learning process? Such an assessment can be obtained through perception studies, as was the common approach for several of the studies reviewed. The second step is learning: what did the participants learn? The second step can be assessed through knowledge quantification. Knowledge assessments were also a common strategy among many of the studies reviewed and a common strategy for nursing education. Nurse educators commonly administer examination questions to nursing students to quantify student knowledge. The third step is behavior: what changes in job performance resulted from the learning experience? Kilday et al. (2013) employed performance measures in their study through the use of the ERP instrument before and after the learning intervention. The fourth and final step of Kirkpatrick’s model is
results: what are the tangible results of the learning process in terms of improved quality, improved incidents of PAEs, and decreased cost? This step is a difficult aspect of evaluation to execute, as time is required to observe the impact of team training while being able to exclude extraneous variables that may impact the effectiveness of the intervention.

**Experiential Learning Theory.** A second commonly used theoretical framework utilized in the study of team science is Experiential Learning Theory. The theory was created by educational theorist Dr. David Kolb (1984) and explains a holistic perspective to learning. The Experiential Learning theory presents a cyclical model of learning, consisting of four stages. The first stage is concrete experience or actively experiencing an event. The second stage is reflective observation or understanding the meaning of ideas and situations by carefully observing and impartially describing them. The third stage is abstract conceptualization or attaching concrete meaning to symbolic system. The final stage is active experimentation or testing experimental hypotheses, goals or strategies based on previous results. Kolb identifies four learning styles that correspond to the four stages of learning. Assimilators learn better when presented with sound, logical theories. Convergers learn better when provided with practical application of concepts and theories. Accommodators learn better when provided with hands-on experiences. Divergers learn better when allowed to observe and collect a wide range of information.

Clinical simulation research often utilizes Kolb’s Experiential Learning Theory because the simulated environment aligns with this model of knowledge acquisition (Aliner, Hunt, & Gordon, 2004; Kaakinen & Arwood, 2009). Simulation allows the four stages of Experiential Learning Theory to occur through the process of pre-brief, scenario experience, and debrief. The pre-brief occurs before the simulated experience and sets the stage for the type of learning that
will occur (a preference for Assimilators). The scenario experience offers hands-on learning (a preference for Accommodators and Convergers). The process of debrief involves a review of the experience, and allows for critical reflection along with instruction (a preference for Divergers). Because many team training studies occur in the simulated clinical environment, many studies employ Experiential Learning Theory as a guiding framework.

**Leadership Theory.** An alternative theoretical perspective to explore team science is the use of leadership theories. Leadership theories focus on examining the important role of leaders on team performance, team improvement and team adaptation (Lorinkova, Pearsall & Sims, 2013). Leadership theories translate to healthcare team science because of the healthcare hierarchy’s organizational nature as well as the complexity of delivering high-quality medical care. Team leadership theories seek to describe the process by which an individual influences a group to achieve a common goal (Northouse, 2010).

Many leadership theories exist and are categorized by the nature of leadership. Leadership theories can explore leadership through the trait (inherent ability) versus process (learned behavior) approach, style (inherent ability) versus skill (learned behavior) approach, or situational approach (Northouse, 2010). Several team training studies have utilized leadership theories to understand team problem solving, provide performance expectations and acceptable interaction patterns, synchronize and combine individual team member contributions, and clarify team member roles (Cannon-Bowers et al., 1995; Salas, Burke, & Stagl, 2004; Barach & Weingart, 2004; Sharma, Boet, & Bould, 2011). The role of understanding leadership theories as they relate to the proposed study is not to deconstruct various theories but rather, to understand the potential this framework holds in the creation of new team knowledge.
A New Conceptual Framework

An innovative approach for the study of team training in a simulated environment is offered by Stocker, Burmester, & Allen (2014). The authors call for a new conceptual framework that blends Kolb’s Experiential Learning Theory, Dewey’s theory of reflective thought and action, Bandura’s Social Learning Theory, and Engestrom’s Activity Theory to inform the development, design and delivery of education programs for simulated team training. The authors propose several statements that support the use of this blended theory.

First, the authors propose a successful simulation experience contains a scenario that allows for a concrete experience along with debriefing. Additionally, the authors call for the scenario to include reflective observation, abstract conceptualization followed by a second scenario for active experimentation. The influence of Kolb’s theory is evident in this statement.

Second, the authors call for instructors to create learning experiences that will challenge participants based upon real events and teach to the learners’ background to facilitate feelings of inadequacy in an effort to motivate learning. This statement is influenced by Kolb and Dewey’s theories. The third statement calls for debriefing that challenges participants to explore their existing frameworks and principles. The authors suggest instructors conduct post simulation education sessions (debriefs) that guide learners in an open and secure way. Kolb and Dewey’s theories are once again supported in this statement. The fourth statement calls for scenarios that include real team members of different specialties and levels of expertise similar to the practice environment. The authors call for the gap between simulation and reality to be as small as possible. The fourth statement is rooted in Bandura’s Social Learning Theory. The fifth and final statement is rooted in the Activity Theory of Engestrom. The statement mandates a social
and cultural context of a team for all team training experiences. In other words, simulation activities should occur in-situ to maintain fidelity and to introduce context to the program.

Stocker and colleagues (2014) present an innovative debate for the integration of theories into clinical simulation scenarios. The authors have thoughtfully combined theories that present a holistic perspective of instruction in the simulated clinical environment. The proposed conceptual framework is comprehensive and speaks to the seven standards of best practice in simulation put forth by the International Nursing Association for Clinical Simulation and Learning (International Nursing Association for Clinical Simulation and Learning, 2013). Further study of this conceptual framework is warranted.

Other Suitable Theoretical Frameworks

Several theoretical frameworks have been presented which relate to the study of team science. Kirkpatrick’s theory is helpful to understand the effectiveness of training. Kolb’s Experiential Learning Theory is appropriate for studies that occur in the simulated clinical environment. A plethora of leadership theories exist to support the study of team processes in healthcare. Innovative theory, such as the one put forth by Stocker and colleagues (2014), hold promise for further discovery of team science. While an argument could be made to utilize any one of the theories presented, it was this author’s belief that the Dickinson and McIntyre’s (1997) Teamwork Model is the best choice to explore psychometric properties of the TPOT.

Rationale for Use of the Teamwork Model Framework

After considering the various theoretical frameworks previously described, the Teamwork Model was the best theoretical framework to support psychometric study of the TPOT. The TPOT concepts integrate well with the structure of the Teamwork Model. The Teamwork Model also explains the process of team performance in accordance with the TPOT
perspective. Utilization of the model with psychometric testing of the TPOT strengthens the Teamwork Model while simultaneously providing greater understanding of the instrument’s utility.

**Teamwork Model**

Dickinson and McIntyre developed the Teamwork Model after a thorough review of team training and performance literature. The authors discovered “few efforts have been devoted to investigating the components of teamwork and…to developing measures of those components” (Dickinson & McIntyre, 1997, p.20). The authors operationalize seven core components of teamwork and their relationships to explain the process of team performance.

**Teamwork Model and TPOT Purpose**

The purpose of the Teamwork Model is to describe the process of team performance. Similarly, the purpose of the TPOT is to provide data related to a particular team’s performance. The TPOT is an instrument included in the TeamSTEPPS® 2.0 curriculum. The TPOT was created to serve as an outcome measure related to the effectiveness of the TeamSTEPPS® curriculum. The instrument was intended to serve as one step of evaluation based on Kirkpatrick’s (1959) steps of evaluating training programs.

The TeamSTEPPS® program offers a collection of instruments, each with the intent of providing assessment for Kirkpatrick’s steps of evaluation (Kirkpatrick, 1959). The TeamSTEPPS® curriculum offers sample course evaluations to evaluate step 1: reaction. Course evaluations are suggested to gauge participants’ reactions to TeamSTEPPS® instruction. The T-TAQ is provided to evaluate step 1 and step 2 (learning) if administered to participants repeatedly. Repeated administration of the T-TAQ allows course facilitators the opportunity to monitor participants’ attitudes over time through evaluation of attitude changes. The TPOT is
intended to evaluate step 3 (behavior) of TeamSTEPPS® training. Performance assessment allows for direct observation of behaviors and serves to validate T-TAQ scores. Step 4 (result) is assessed through unit/hospital quality measures such as improvement in the rate of patient falls, decreased length of stay, and increased patient satisfaction.

**Teamwork Model and TPOT Concepts**

The Teamwork Model contains seven concepts (Figure 3). The seven concepts are: Communication, Team Orientation, Team Leadership, Monitoring, Feedback, Backup, and Coordination. The TPOT addresses five core components of team performance (Figure 1). The five core components are: Team Structure, Communication, Leadership, Situation Monitoring, and Mutual Support. Backup behaviors are imbedded in the mutual support domain of the TPOT. Coordination is embedded in the team structure, leadership, situation monitoring, and mutual support domains. Concepts of the Teamwork Model and the TPOT are equally represented.

**Teamwork Model and TPOT Assumptions**

The Teamwork Model and TPOT assumptions are similar. Chapter One identified the assumptions of the Teamwork Model to include: individual members possess the requisite technical skills and knowledge to perform their own tasks, individual members possess positive attitudes toward the team and its task, leaders and members focus attention and concern on improving teamwork rather than individual success and performance, individual team members possess a willingness to provide and seek help, tasks are interchangeable within the team allowing for backup support to be offered. Assumptions of the TPOT align with assumptions of the Teamwork Model.
Summary

The preceding pages offered an overview of what is and is not known regarding team science and healthcare team training. A variety of methods to explore team training and theoretical constructs related to team science have been identified. The Dickinson and McIntyre Teamwork Model has been described and an explanation provided regarding how integration of the model supports this study. Evidence for the need of this theory-linked study has been established.
Chapter Three
Introduction

This chapter describes the methodology used to establish baseline psychometric properties of the TeamSTEPPS® 2.0 TPOT. The Dickinson and McIntyre Teamwork Model served as the theoretical framework to guide the investigation. Validity of the TeamSTEPPS® 2.0 TPOT was determined through content, construct, and concurrent validity testing. Reliability was established by evaluation of internal consistency, inter rater, and test-retest reliability.

Methods

Overview of Study

The study utilized a descriptive, quantitative approach to determine baseline validity and reliability of the TeamSTEPPS® 2.0 TPOT. A group of seven team science experts were recruited to provide an assessment of TPOT item relevance in an effort to describe content validity. Three experts were identified as having published several papers related to team science. Three other experts were identified as members of high functioning medical teams. One expert was an international healthcare team trainer. The experts were sent an email inviting them to participate in the study. A Survey Monkey link was provided to access the informed consent and survey (Appendix E).

Over five hundred TeamSTEPPS® trained healthcare professionals were recruited via email invitation from professional contacts, TeamSTEPPS® training participant lists, and professional social media (LinkedIn) to view and score five video-recorded simulated team events to provide evidence of construct validity. The recordings were of nursing student teams enrolled in an acute deterioration course (NURS 4490) in Fall 2011 and Spring 2012 semesters. Study participants viewed and scored as few as one and as many as five team performances using the TeamSTEPPS® 2.0 TPOT and the Team Emergency Assessment Measure (TEAM). The
TEAM instrument served as a measure of concurrent validity. Study participants were invited to independently view the recordings and provide all instrument scoring through an online survey system (Appendix F). Data collection took approximately sixty minutes to complete the viewing and scoring of the five videos. Participants were awarded a desk clock valued at twenty-five dollars.

Data collection also occurred among groups of study participants who were recruited immediately following a face-to-face TeamSTEPPS® training session. Two participant groups were recruited in this manner. Group participants viewed a series of five team performance videos collectively. Immediately following each video review, TPOT and TEAM instruments were scored independently using a paper version of the study instrument identical to the online survey.

Individual online participants and face-to-face study participants who completed reviewing and scoring of the five videos were randomly selected approximately two weeks after data collection to serve as a rater for a second viewing of the five video recordings and TPOT scoring to evaluate test-retest reliability. The retest raters were invited via email communication and a link to the online survey (Appendix G). Participants who completed retest scoring were provided a fifty-dollar Visa gift card.

Design

The study utilized a descriptive, quantitative design. The rationale for this design was to provide evidence of the validity and reliability properties of the TPOT. Nunnally and Burnstein (1994) state, a “measure is standardized to the extent that (1) its rules are clear, (2) it is practical to apply, (3) it does not demand great skill of administrators beyond that necessary for their
initial training and (4) its results do not depend upon the specific administrator” (p.4). The study was the next step in evaluating these attributes of the TPOT.

**Research Procedures**

Written consent was sought from all students enrolled in NURS 4490 during Fall 2011 and Spring 2012 semesters (Appendix C). Once students’ consent for use of pre-recorded videos was obtained, a review of pre-recorded videos occurred by the researcher to determine five videos to include in the study. Videos were reviewed for clarity of recording (adequate image and sound quality) as well as initiation of the medical team.

After the five videos were identified for inclusion, the videos were edited to include title and conclusion acknowledgements. Conclusion acknowledgements indicated the copyright of the videos and that videos were only to be used in relation to the study. Dissemination or copying of the videos was prohibited.

Once the videos were properly edited, five videos were loaded to the Vimeo website. The Vimeo service allowed the videos to be password protected. This password protection ensured only individuals consented to participate in the study viewed the videos.

The five videos were arranged on the Vimeo website in a particular order that remained consistent throughout data collection. This sequencing allowed TPOT scores to be tied to specific performances. The sequencing of videos was as follows: video one (end of NURS 4490 course), video two (middle of NURS 4490 course), video three (end of NURS 4490 course), video four (beginning of NURS 4490 course), and video five (end of NURS 4490 course). Participants were not informed of the variability in performance prior to data collection. The reason for withholding this information was to minimize assumptions of raters prior to scoring the performance.
Once the survey and videos were ready for review, TeamSTEPPS® trained healthcare professionals were recruited from professional contacts, participant lists received at the conclusion of TeamSTEPPS® training events, and professional social media (LinkedIn). Recruited individuals were provided a secure link to the informed consent, videos, and scoring instruments. Participants viewed the videos independently online. The data collection session began with an informed consent document, study overview, and completion of demographic questionnaire (Appendix E). Participants were asked to review one video at a time and immediately score the performance using the TPOT and TEAM instruments. After scoring the instruments for the recorded team performance was completed, subsequent videos were reviewed and scored in an identical manner. Once data collection was complete, participants were asked to indicate their interest in the study incentive. Those that agreed to the incentive were asked to provide a mailing address so the study incentive could be delivered.

Data entry occurred at the time of data collection as study participants scored each team performance into an online survey website (Survey Monkey). Demographic data and TPOT scores were analyzed using the IBM® SPSS Statistics 22 (SPSS) program. The survey compiled a file for export to SPSS.

When online enrollment of study participants stalled, group data collection sessions were offered at the conclusion of TeamSTEPPS® training sessions. Data were collected in this manner on two separate occasions with participants from two separate schools of nursing. Participants in group sessions were provided paper consent forms along with paper versions of the TPOT and TEAM instruments. A request was made at the beginning of the data collection to avoid verbal and non-verbal communication in an attempt to minimize the influence of scoring among participants. Group participants viewed the videos together one performance at a time and
immediately completed TPOT and TEAM scoring. The review and data collection occurred in a similar manner as data collection with the online participants. Group participants received the study incentive at the conclusion of the session. The study author immediately entered the participant responses into the Survey Monkey system using the manual entry feature to ensure one central repository for all study data.

**Rationale for TPOT Study**

Psychometric testing of the TPOT was justified because the TeamSTEPPS® curriculum is the most commonly used curriculum for healthcare team training in the world (Baker, 2014). The TPOT is the only performance metric available from the TeamSTEPPS® program and psychometric properties are underreported. Establishing psychometric properties of the TPOT provides organizations with greater evidence of a valid and reliable instrument to assess team performance from the TeamSTEPPS® perspective.

**Rationale for Use of TEAM Instrument**

Use of the TEAM instrument was justified to serve as a means of establishing concurrent validity. Concurrent validity is a measure of how well a particular test correlates with a previously validated measure (Shuttleworth, 2009). Tests are for the same, or very closely related, constructs and allow for a means to validate new methods (TPOT) against a tried and tested stalwart (TEAM). Psychometric properties of the TEAM data have been reported (Cooper et al., 2010). The TEAM evaluates team performance from the perspective of leadership, teamwork, and task management, which are similar constructs measured with the TPOT.
Pre-recorded Versus Live Team Simulation Performance

The use of video recordings in nursing research has been utilized for many years and is a well-established method of data collection (Caldwell & Atwal, 2005). Video recordings allowed non-participant observation in an effort to capture the occurrence of the phenomenon in a natural state without the intrusion of the researcher. Video recordings also allowed for repeated viewing as needed. Using more than one observer to view and analyze the recording enhanced the validity of the observation (Caldwell & Atwal, 2005).

Psychometric testing of the TPOT could have occurred through the use of pre-recorded team simulation performances or through the scoring of live team simulation performances. This research study utilized pre-recorded team simulation performances of nursing students enrolled in an acute patient deterioration course. Improved standardization of the study, efficiency, and reproducibility of team events were key reasons to utilize pre-recorded team simulation performances.

All human activity is variable. The use of pre-recorded team simulation performances was an effort to minimize variability because all study participants viewed identical performances. The pre-recorded sessions used in the study were reviewed by Hart and colleagues (2014) and found to demonstrate improved team function in repeated simulation events. For this reason, it was anticipated TPOT scores would also improve with the same teams over time. Knowing the quality of videos beforehand ensured study participants had the opportunity to view the phenomenon (team performance). Conversely, it could not be ensured a team performance would have been observed with live performances because participants may not have recognized the critical health event or had the knowledge to call for help and activate
the team. Minimizing the performance variable inherent in live performances helped to standardize the research design.

A second reason to utilize pre-recorded team simulations was reproducibility. Videos were played repeatedly to increase the number of observations. Increasing the number of observations increased the power of the study. Online participants had the opportunity to pause or restart the recordings if/when interruptions occurred during data collection. Participants in face-to-face sessions viewed each video once from beginning to end in an effort to standardize the experience among the group.

Efficiency was a third reason to employ pre-recorded team simulations. The use of pre-recorded simulations allowed for data collection to occur at a time convenient for study participants without having to secure simulation space or assemble a team. Flexibility in scheduling data collection was a positive recruitment strategy.

While human behavior is difficult to predict, the use of pre-recorded team simulations helped to significantly minimize this threat to validity. The use of team performance recordings that were previously validated strengthened the study. Standardization of methods, reproducibility, and efficiency were all realized through the use of pre-recorded team performance simulations.

**Rationale for Use of Team Videos**

The rationale for using team performance videos obtained from NURS 4490 was threefold. First, a team of experts had analyzed the videos and the presence of team performance was confirmed (Hart, 2014). Second, access to former students who participated in team video recordings was convenient and allowed for immediate availability of team performance recordings. Third, the video recordings were accessible.
The course coordinator and principle investigator of the study in which the recordings were made verbalized authorization to use the videos once authorization from the recorded team members was received.

**Rationale for Online Data Collection**

Online data collection allowed for less error in data entry. Transcribing data from paper forms to computerized databases can decrease the reliability of findings due to transcription errors. Evidence suggests up to a 26.9 percent error rate in data transfer (Atkinson, 2012). Direct entry of data also allowed for more efficient data analysis because the researcher did not have to manually enter all study data. Surveys collected in face-to-face sessions were immediately entered into the Survey Monkey database and rechecked by the researcher in an effort to improve accuracy of data entry.

Online data collection allowed for greater access to TeamSTEPPS® trained healthcare providers. Utilizing a web-based service for data collection meant individuals from across the country could participate in the study at any given time of day. An online method for data collection provided a greater geographic representation of study participants and was more economical than the study researcher traveling to participants for all face-to-face sessions.

**Procedures for Collection and Treatment of Data**

**Access to Study Participants**

Access to study participants occurred through various approaches. Authorization for use of team video recordings was necessary and occurred before consenting TeamSTEPPS® trained healthcare professionals to ensure the required number of team recording videos were secured. Access to TeamSTEPPS® trained healthcare professionals and team science experts required a different approach.
Authorization for use of team video recordings occurred first. Former students enrolled in Fall 2011 and Spring 2012 semesters of NURS 4490 were recruited via direct email contact (Appendix B). Course rosters were obtained from the university registration program (Owl Express). Students who participated in the NURS 4490 research study were notified via email addresses on record with Owl Express. The email to each student can be found in Appendix B. A list of students who responded to the email was maintained. Former students who responded and agreed to participate were recorded and names verified with the groups in which the participants were assigned while enrolled in NURS 4490. Email communication was not effective in reaching all former students so direct mailings were employed to ensure authorization of video use. Documentation of consent for use of recordings was maintained via email communication or written documentation (Appendix C) depending upon the method used for obtaining consent.

Once the authorization for use of the videos was obtained, Institutional Review Board (IRB) approval was sought for the study. The study was determined to be exempt from complete review due to the nature of data collected (Appendix D). Data collection for the study then began.

Following IRB approval, TeamSTEPPS® trained healthcare professionals were sent an email invitation to participate in the study. Reminder emails to complete the survey were sent two weeks after the initial contact. A convenient expert sampling technique was employed to recruit TeamSTEPPS® trained professionals. When participant recruitment efforts resulted in a less than desirable sample size, the snowball sampling technique was employed. Wasserman, Pattison, & Steinley (2005) described the snowball sampling technique as a method of recruitment used to overcome the
challenge of inviting difficult-to-reach populations. Exponential discriminative snowball sampling finds an individual who has the desired characteristics and uses the person’s social networks to recruit similar participants in a multistage process. After the initial sources help to recruit respondents, the respondents then recruit others themselves (Sadler, Lee, Lim, & Fullerton, 2010). When participant enrollment stalled, two TeamSTEPPS® training sessions were offered at two schools of nursing. Enrollment in the study and data collection occurred immediately following the training sessions.

While recruitment, enrollment, and data collection was occurring, seven team science experts were asked to participate in the study to provide content validity. Three team science experts were identified as having published on the topic of team science. Three other team science experts were identified as being members of high functioning medical teams. One expert was an international healthcare team trainer. All experts were invited to participate in the study via email communication.

**Type of Data**

Quantitative data were collected for the study. Data included de-identified personal demographic information of study participants. The purpose of collecting personal demographic information was to determine descriptive statistics of the study sample. Descriptive statistics provide simple summaries about the sample (Trochim, 2001). A second type of quantitative data collected was the rating of TPOT items by team science experts. The third type of data collected was quantitative TPOT and TEAM scores. The collection of TEAM scores was necessary to provide a means of concurrent validity.
Data Collection Procedures

Seven team science experts were contacted via email and invited to participate in the study. The email connected to a Survey Monkey web link (Appendix E). The link opened in a new window. Participants viewed an informed consent on the first page. After review of the informed consent, page two sought demographic data information requesting confirmation the participant was 18 years of age or older. If a participant indicated they were not 18 years of age, the survey redirected to a disqualification page. Demographic information also sought the state and zip code of residence and years engaged in team science activities. Page three of the survey was a ranking of each of the 23 TPOT items from 1 = not relevant to 4 = highly relevant.

TeamSTEPPS® trained individuals were contacted via email and invited to participate in the study. The invitation email contained a Survey Monkey web link. The link opened in a new window. Participants viewed an informed consent on the first page. If a participant was not 18 years of age, the survey redirected to a disqualification page. After review of the informed consent, page two of the survey sought demographic information. Participants were required to enter their year of TeamSTEPPS® training. If a participant choose the survey option, “I have not completed TeamSTEPPS® training. *Prior training is a requirement to participate in the study*”, the survey redirected to a disqualification page. This option was imbedded to ensure participants had previous TeamSTEPPS® training. After demographic information was completed, the third page of the survey included a link to the first team performance video. Participants were instructed to view the performance and score the performance using the TPOT instrument. The TeamSTEPPS® 2.0 TPOT was constructed in the survey to match the current version available. Drop-down options were available to ensure whole number scoring. The survey was constructed to force scoring of all instrument items. For example, if a participant failed to provide a score for
one item of the TPOT, the survey did not advance to the next page. This was an effort to ensure complete data sets were captured. The fourth page of the survey included a reference to video one and encouraged participants to score the performance using the TEAM instrument. The TEAM instrument was constructed in the survey to match the current version available (Cooper et al., 2010). The TEAM survey was also designed to ensure collection of all instrument items and whole number scoring. Participants proceeded to page five of the survey with a link to video two. Data collection occurred in subsequent fashion until all five videos were reviewed and scored completely. Once all videos were viewed and scored, participants advanced to page thirteen of the survey with an option to include a preferred mailing address for delivery of the study incentive (a twenty-five dollar desk clock). Providing an option to defer the study incentive maintained anonymity of study participants. Page fourteen of the survey provided a thank you message to participants. The time to complete the informed consent, review and score five team videos was approximately sixty minutes.

Face-to-face participants were recruited immediately following a two hour TeamSTEPPS® Essentials training program. Participants were given a paper version of the consent form. Once informed consent was completed, participants were instructed to avoid verbal and non-verbal communication with other session participants. Team performance videos were then projected on a large screen to view each video in its entirety. At the conclusion of each video, participants scored the performance using the TPOT and TEAM instruments. The surveys were collected and new surveys were handed out prior to each video review to ensure participants were scoring the correct video. Data collection took approximately sixty minutes for each group session.
**Data Management**

Study data were protected through several approaches. Study data were directly entered into the password-protected Survey Monkey program. This data collection strategy eliminated the risk of losing or mishandling paper copies. Study data collected in face-to-face group sessions were entered into the Survey Monkey program by the study researcher at the conclusion of each session and secured in a locked cabinet. Data resided on the Survey Monkey website until information was queried and downloaded. The researcher was the only person with access to the online survey and completed data. The Survey Monkey subscription was paid through October 2016 to be renewed annually as needed. Survey Monkey provided the researcher with a unique username and the account was password-protected. Survey Monkey provided a daily overview of the active survey to include the number of new responses since the last notification and how long the survey had been open. Data were downloaded from the Survey Monkey website to both a password-protected computer and password-protected Internet cloud service with each completed survey. All survey summary data, all response data, and all individual responses were included with each download. All response data were downloaded into a SPSS data file for analysis. Data will be maintained until 2020, at which time data files will be deleted.

**Data Analysis**

Demographic data and TPOT scores were analyzed using IBM SPSS version 22. The program allows for statistical analysis, data management, and data documentation (International Business Machine, 2014). Study data collected via Survey Monkey were exported to a Microsoft® Excel data file. The data file was then imported to the SPSS application for statistical analysis.
Statistical Techniques

Validity Procedures

Exploring validity is a necessary step when determining psychometric properties of the TPOT. “One validates, not a test, but an interpretation of data arising from a specified procedure” (Cronbach, 1971 p.447). Validity is the extent to which any measuring instrument measures what it is intended to measure. Thus, one validates not the measuring instrument itself but the instrument in relation to the purpose for which it is being used (Carmines & Zeller, 1979, Stewart & Archbold, 1997). Three types of validity (content, construct, and concurrent) were explored in an effort to determine baseline psychometric properties of the TPOT.

Content validity. Content validity is the “determination of the content representativeness or content relevance of the items of an instrument by the application of a two-stage process” (Lynn, 1986, p.382). The first stage begins in the Development Stage. Three steps are identified in this phase. Step one is the identification of full content domains. This step has been achieved by utilizing the Dickinson and McIntyre Teamwork Model to provide a framework for the TPOT variables. Step two (sampling and item generation) and step three (assimilation of items into usable form) have already been completed through the creation of the TPOT.

The second stage of content validity is the Judgment-Quantification Stage. Two steps are associated with this stage. The first step is assertion by a specific number of experts that the items are content valid. The number of experts depends on how many accessible and agreeable experts are available. Five experts are the minimum preferred however, when access to a large number of experts is difficult, three experts are acceptable (Lynn, 1986). The second step of the Judgment-Quantification Stage is judgment/quantification of content validity of the instrument. If there are five or fewer experts all must agree on the content validity for their rating to be
considered a reasonable representation of the possible ratings. The index of content validity (CVI) is derived from the rating of the content relevance of the items on an instrument using a 4-point ordinal rating scale where 1 connotes an irrelevant item and 4 an extremely relevant item. The CVI is the proportion of items that received a rating of 3 or 4 by experts (Lynn, 1986). A CVI of .78 on individual items (I-CVI) is considered acceptable and an average scale (S-CVI/Ave) rating greater than .90 is acceptable (Polit & Beck, 2006). The study sought seven expert TeamSTEPPS® trainers and a combined rating greater than .78 on TPOT individual item relevance and .90 on the overall TPOT scale relevance.

**Construct validity-item analysis.** Trochim (2001) describes construct validity as an evaluation of how well the assessment (the TPOT instrument) reflects the ideas one is trying to measure (team performance). An initial assessment of construct validity involves item analysis. Item analysis includes the means and standard deviations of each TPOT item to evaluate scoring tendencies. Next, a correlation matrix is reviewed to evaluate the correlation of items to one another. Ideally, items in the correlation matrix will correlate with one another fairly well but not perfectly (Field, 2009). Perfect correlation is also termed singularity and indicates repetitive items that should be deleted. Conversely, any variables that correlate highly with other items indicate multicollinearity and should be deleted. Inter item correlations between .3 and .9 are acceptable and were sought for each TPOT item (Field, 2009).

**Construct validity-factor analysis.** Factor analysis is an approach to provide evidence of construct validity (Devon et al., 2007). A factor analysis is a method of data reduction. The reduction occurs by seeking underlying unobservable variables reflected in the observed variables. A factor is a combination of test items that are believed to belong together. Related items define a part of the construct and are grouped together. Unrelated items that do not define
the construct should be deleted from the tool (Munro, 2005). Exploratory factor analysis (EFA) is used to identify the greatest variance in scores with the smallest number of factors, an eigenvalue greater than 1.0 is the statistical expression (Devon et al., 2007). Confirmatory factor analysis (CFA) follows EFA and seeks to validate the extent to which the statistical models fit the actual data. One type of CFA is the maximum likelihood factor analysis. The maximum likelihood factor analysis provides a statistical measure of the goodness of fit of the factor solution (Field, 2009). Data reduction for a maximum likelihood factor analysis is achieved by explaining the maximum amount of common variance in a correlation matrix using the smallest number of explanatory constructs (Field, 2009).

Factor analysis is a technique that requires a large sample size. Tabachnick and Fidell (2001) regard sample sizes of 50 cases as very poor, 100 cases as poor, 200 as fair, 300 as good, 500 as very good, and 1000 or more as excellent. The study sought 50 experts viewing five videos or 250 total observations. The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) value greater than .7 indicates adequate sample size. The study sought a KMO value greater than .7. The Bartlett’s test of sphericity indicates item correlations are large enough to make the analysis meaningful and an identity matrix is not present. The study sought a Bartlett’s test of sphericity significant level less than or equal to .05.

**Factor extraction.** The purpose of factor extraction is to determine if a factor is statistically important (Field, 2009). Eigenvalues provide a method for extracting factors and organizing TPOT items. Eigenvalues greater than 1 and a factor loading of .4 were utilized to establish the number of TPOT factors.

**Factor rotation/Factor loadings.** Factor rotations serve to improve the meaningfulness and interpretation of unrotated factors (Pett, Lackey, & Sullivan, 2003). Factor rotation is a
method of turning the reference axes of the factors in an effort to achieve a more theoretically meaningful and simple structure of items (Pett, Lackey, & Sullivan, 2003). There are two general classes of rotation, orthogonal and oblique (Pett, Lackey, & Sullivan, 2003). Both types of rotations seek a simple structure but have different underlying assumptions. The orthogonal rotation assumes the generated factors are uncorrelated (Pett, Lackey, & Sullivan, 2003). In the oblique rotation, the assumption is that some correlation exists between two or more of the factors being rotated (Pett, Lackey, & Sullivan, 2003).

There are three types of orthogonal rotations: varimax, quartimax, and equamax (Pett, Lackey, & Sullivan, 2003). The most commonly used orthogonal rotation is varimax. The goal of the varimax rotation is to simplify the columns of the unrotated factor-loading matrix (Pett, Lackey, & Sullivan, 2003). The columns are simplified in this rotation by maximizing the variances of the loadings within the factors while also maximizing the differences between the high and low loadings on a particular factor (Pett, Lackey, & Sullivan, 2003). An advantage of the varimax solution is that "the solution is easily interpreted and provides relatively clear information about which items correlate most strongly with a given factor" (Pett, Lackey, & Sullivan, 2003, p.142). Factor scores are thereby more interpretable because the explained variances among the factors are independent of one another resulting in a simple structure. For this reason, the varimax solution was chosen for this study.

The quartimax and equamax rotations are not as commonly used as the varimax rotation. The quartimax rotates the factors in an effort to maximize the squared loadings for each variable so as to enable each item to load most strongly on a single factor (Pett, Lackey, & Sullivan, 2003). The quartimax rotation most often results in a single general factor and is a useful solution to use if a general factor is suspected (Pett, Lackey, & Sullivan, 2003). The equamax
rotation is a combination of both the varimax rotation and quartimax solutions. Factors and items are simultaneously simplified. The equamax is suggested for use only when the number of factors is known (Pett, Lackey, & Sullivan, 2003).

An orthogonal, varimax rotation was used in an effort to more easily interpret the correlation of items with each factor. Item factor loadings greater than .45 were sought to determine item placement among factors.

**Concurrent validity.** Concurrent validity measures explored the relationship between the TPOT and a like instrument. For the purpose of this study the TEAM, which has established validity and reliability was used. The correlation coefficient between scores was evaluated using the Spearman’s correlation coefficient. The Spearman’s correlation coefficient is a measure of non-parametric variables (Trochim, 2001). Spearman's correlation coefficient measures the strength of association between variables.

**Reliability Procedures**

Psychometric testing must not only determine the validity of a measure but the reliability as well. Reliability is the extent to which a measuring instrument yields the same results on repeated trials. The study explored inter-rater, test-retest, and internal consistency in an effort to establish baseline reliability of the TPOT.

**Internal consistency reliability.** Internal consistency indicates how well items on a tool fit together conceptually. The reliability of the instrument is determined by estimating how well the items that reflect the same construct yield similar results (Trochim, 2001). Cronbach’s alpha coefficient is the most frequently used statistic to demonstrate internal consistency reliability and is mathematically equivalent to the average of all split-half estimates from the same sample. Cronbach’s alpha coefficient is the only reliability index that can be performed with one test
administration (Devon et al., 2007). If items are not correlated, the value of alpha is reduced. A coefficient alpha of .7 is acceptable for new scales and most authors report an ideal alpha of .95 (DeVellis, 2003). Cronbach’s alpha coefficient was computed for the total TPOT scale and each subscale. A Cronbach’s alpha equal to or greater than .7 was considered acceptable to establish internal consistency for the TPOT.

**Test-retest reliability.** The test-retest method of exploring reliability is estimated by administering the same test to the same group of respondents at different times. The two scores are correlated between individual questions and indicates the stability of the instrument. The time between retesting should be long enough that respondents do not remember their original responses but not long enough for their knowledge of the material to have changed. Trochim (2001) suggests the longer the time, the lower the reliability and the more likely that attitudes or knowledge have changed. The generally acceptable time interval for retesting is two weeks to one month (Devon et al., 2007). Eleven participants (20% of sample) were randomly selected to serve as raters. The participants were sent the same five videos and a new set of scoring links to complete a second full set of data two weeks after the initial rating. Data were linked through the first three letters of the first name and first three letters of the last name provided at both data collection points. Correlation coefficient of .70 or higher was sought with raters retesting two weeks from the original assessment. The correlation coefficients were expected to remain stable or decrease slightly over time.

**Inter rater reliability.** The inter rater method of exploring reliability was an effort to evaluate consistency between observers. Human behavior is inconsistent. Study participants can become fatigued, distracted, and misinterpret findings during long periods of observations. The inter rater reliability strategy was an effort to calibrate the observers (Trochim, 2001). The study
reviewed cases from six randomly selected volunteer participants. Intra-class correlations for each item as well as total TPOT scores were evaluated. A correlation of one indicates complete agreement and a correlation of 0 indicates agreement equivalent to chance (Viera & Garrett, 2005). A correlation of 0 to .2 indicates poor agreement, .3 to .4 indicates fair agreement, .5 to .6 indicates moderate agreement, .7 to .8 indicates strong agreement, and greater than .8 indicates almost perfect agreement (Field, 2009). Moderate agreement was expected because study inclusion criteria required participant familiarity with the TeamSTEPPS® curriculum.

**Protection of Human Subjects**

Research involving human subjects must maintain ethical standards to ensure the protection of study participants. Individuals must be properly informed of the study design and risk involved prior to participating to avoid undue harm (Hardicre, 2014). The purpose of the Institutional Review Board (IRB) at Kennesaw State University (KSU) is to “regulate all research activities involving human subjects on the campus of Kennesaw State University, ensuring that people who participate in research are treated ethically and in compliance with federal and state laws and regulations” (Kennesaw State University, 2014). Prior to proceeding with the proposed study KSU IRB approval was obtained.

Minimal risk was anticipated to former students who authorized use of their recorded performance. The recorded emergency team event took place more than two years ago, and former students were not subjected to additional interventions by agreeing to participate in the proposed study. Former students were notified of the intent for the use of their recorded team performance and were willingly encouraged to participate. The only individuals to view the recordings were TeamSTEPPS® trained individuals. Study participants were notified that the use of the video recordings was for the sole purpose of the study and were not to be used for
purposes beyond the research study. Additionally, the team performance videos were anonymous with the occasional use of a person’s first name mentioned during their performance. Therefore, no direct harm to the former students participating in the study was anticipated.

Minimal risk was anticipated to team science experts and TeamSTEPPS® trained healthcare professionals who agreed to participate in the proposed study. Participants volunteered to take part in the study. Study participants were informed participation could be discontinued at any time. Data collected were de-identified. No physical or emotional detriment was expected as a result of participating in the study.

Setting

Study Environment

Study enrollment and data collection occurred online or in face-to-face sessions. The study environment was unique to each study participant completing the online survey. An Internet connection to connect to the Survey Monkey website and Vimeo video streaming website along with audio capabilities were required to complete data collection online. Face-to-face participants completed data collection in a large conference room or classroom. Participants were recruited via email.

Data collection occurred through the review of five password protected online videos hosted on the Vimeo website and scoring each performance using the Survey Monkey survey platform for online participants. Due to mobile Wi-Fi capabilities, the study environment could have occurred almost anywhere an Internet connection was available for participants completing the survey online. Participants in face-to-face sessions completed the study using paper surveys.

The variability of study environments necessitated suggestions to participants as to the recommended environment for data collection. Frequent interruptions were a concern for online
participants and for that reason participants were informed data collection would take approximately 60 minutes to complete. A comfortable workspace was suggested due to the time requirement necessary to complete the video review and scoring. Participants were explicitly encouraged to minimize distractions during the data collection period. The instructions read, “The expected time to complete the video recording review and scoring instruments is approximately 60 minutes. A comfortable workspace with minimal distractions is encouraged”.

Face-to-face participants were seated at a comfortable workspace during data collection. Video projection allowed all participants to see and hear the team performance recording without difficulty. Participants were instructed prior to the beginning of data collection to avoid verbal and non-verbal communication. Participants were instructed that each video would be shown once in its entirety. Participants were also informed data collection would take approximately sixty minutes to complete.

**Study Sample**

**Sample**

Psychometric testing of the TPOT necessitated the recruitment of several groups. The first group consisted of 48 Baccalaureate nursing students who were enrolled in Fall 2011 and Spring 2012 semesters of Nursing 4490: Recognition and Response to Acute Patient Deterioration (NURS 4490). The second recruitment group included team experts who could evaluate the instrument to assess content validity. The third group consisted of healthcare professionals who had participated in TeamSTEPPS® training.

**Nursing students.** The 48 Baccalaureate nursing students were recruited from the Fall 2011 and Spring 2012 semesters of NURS 4490. Students who completed this course
participated in a video recorded study exploring the effectiveness of a structured curriculum focused on recognition and response to acute patient deterioration (Hart et al., 2014). Hart and colleagues (2014) reported statistically significant improvement in student team performance in response to a simulated patient care emergency after participation in the course. Digital video recordings were captured of ten groups before the course began, midpoint of the semester, and end of the program. Each video recording captured the performance of a group of no more than five students engaged in the care of a simulated patient medical emergency. At the time of the study, students consented to video recording of their performance for the purpose of participation in the Hart and colleagues (2014) study. Students did not specifically consent to the use of the video recordings beyond the initial study, and for this reason, students were contacted via email (Appendix B) and postal mail to consent to the use of the recordings for the study.

Team science experts. The second group of study participants was team experts. Three participants were identified through published work as content experts in the field of team research. Three experts were identified from their membership on expert medical teams. One expert was an international healthcare team-training expert.

TeamSTEPPS® healthcare professionals. The third group of study participants recruited for the study were healthcare professionals who completed a TeamSTEPPS® training course. Study participants were recruited via email through professional contacts. A convenience sample of over 500 was contacted to allow for attrition of study participants. The contacts were identified through professional contacts, and previous TeamSTEPPS® training participants, and the TeamSTEPS® LinkedIn site.

Inclusion criteria. Several inclusion criteria needed to be met in order for individuals to participate in the study. First, individuals had to be eighteen years of age or older. The
demographic page of the survey required participants to confirm they were eighteen years of age or older. Participants who confirmed they were less than eighteen years of age were sent to a disqualification page and were unable to participate in the study. Second, individuals who scored the TPOT and TEAM instruments had to have completed TeamSTEPPS® training. The participant recruitment contact list was verified by various means. The verification means included the researcher had participated in training with and/or participated in professional activities related to TeamSTEPPS® education. The professional activities include presenting at regional and national meetings regarding the TeamSTEPPS® program as well as serving as an instructor at TeamSTEPPS® training events. An additional inclusion criterion was that online participants had access to a computer with Internet and audio capabilities. Verification of Internet capabilities was confirmed by the completion of data collection. Verification of audio capabilities was difficult to ascertain but was explicitly mentioned in the recruitment email and informed consent document.

**Sample selection.** Identifying individuals who had participated in TeamSTEPPS® training courses and known TeamSTEPPS® experts by way of professional contacts served as the means for sample selection. The recruitment of TeamSTEPPS® trained healthcare professionals was necessary to ensure expert sampling had been achieved. Expert sampling involved assembling persons with known expertise in an area (Trochim, 2001). This sampling technique strengthened the validity and reliability of the study. TeamSTEPPS® trained healthcare professionals were familiar with the principle constructs of the curriculum along with TPOT variables such as huddle, CUS, and DESC. A pilot study by Maguire, Bremner, & Yanosky (2014) determined variability in TPOT scores among TeamSTEPPS® instructors and those unfamiliar with the curriculum.
Instruments

Three data collection tools were utilized for the study. First, a demographic questionnaire was completed. Second, the TeamSTEPPS® 2.0 TPOT (Figure 1) was completed after each video review. The third instrument used in the study was the TEAM (Figure 2). The TEAM was administered immediately after each TPOT completion to ensure the TEAM instrument was scoring the same performance as the TPOT. The link to view and score the five team performances was available to study participants via the following web link: https://www.surveymonkey.com/s/SFL5NMB.

Demographic Questionnaire

A three-item demographic questionnaire (Appendix E) was provided to the seven team science experts in an attempt to understand the geographic representation of the group. The length of time the participants had been engaged in team science was also explored in an effort to quantify the average length of expertise.

A nine-item demographic questionnaire (Appendix F) was provided in an effort to understand the characteristics of study participants taking part in TPOT and TEAM scoring. First, a unique identifier was established in an effort to pair data related to test-retest reliability analysis. The unique identifier enabled matching of data from two separate time points. Second, participants were asked to confirm they were over eighteen years of age. Third, study participants’ geographical region of residence was sought. Participants provided their state and zip code of residence. Because the study utilized the exponential discriminative snowball sampling technique, the geographic representation of study participants was explored. Fourth, the employment setting of study participants was ascertained. Participants were asked to identify their setting of employment as well as the number of years they had been employed in this
capacity. Fifth, participants were asked to identify the highest degree obtained. Sixth, participants were asked to identify the year they completed TeamSTEPPS® training. The year of TeamSTEPPS® training served to validate that participants had met inclusion criteria. Seventh, experience with the TeamSTEPPS® curriculum was identified. Finally, participants’ familiarity with evaluating performance-based assessments was sought. Overall, a range of demographic information was explored in an effort to define the sample and evaluate scoring tendencies.

**TeamSTEPPS® 2.0 TPOT**

The TeamSTEPPS® 2.0 TPOT is a 23-item, 5-point Likert scale observation tool. The purpose of the TPOT is to provide data regarding team performance based upon five key principles related to teamwork process. The five domains are Team Structure, Leadership, Situation Monitoring, Mutual Support, and Communication. Each domain contains four to six variables related to one of the domains of team process. The rating scale is from 1 (very poor) to 5 (excellent). A scoring manual for the TPOT is not currently available (Almeida, 2009) therefore; scoring must be explicitly defined with each administration of the TPOT. Participants were advised, “Consider observed behaviors only. When completing the rating scale for each item, make a judgment on the overall performance. Consider the global team performance, not performances by each individual.” The scoring instructions appeared with each administration of the TPOT.

**TEAM**

The TEAM is a 12-item observation tool developed to measure emergency resuscitation team performance (Cooper et al., 2010). The TEAM is divided into four sections (Figure 2). The first eleven variables are based on three domains of team process: leadership, teamwork, and task management. The rating scale is from 0 (hardly ever) to 4 (always/nearly always). The
twelfth item is a global rating of the team performance based on a Likert scale from 1 (lowest performance) to 10 (highest performance). Scoring instructions were available and were identical to the instructions given with the TPOT. The scoring instructions read, “Consider observed behaviors only. When completing the rating scale for each item, make a judgment on the overall performance. Consider the global team performance, not performances by each individual”. The instructions sought to support standardization of performance observations between TPOT and TEAM scoring.

Reliability and Validity of Tools

TeamSTEPPS® 2.0 TPOT. After an exhaustive search of the literature, no report of the psychometric properties of the TeamSTEPPS® 2.0 TPOT had been found. Maguire and colleagues (2014) report initial psychometric properties of the first TeamSTEPPS® TPOT (25-item version). A knowledge gap therefore existed between the psychometric properties of the 25-item TPOT and the newer 23-item version. Identifying psychometric properties of the TeamSTEPPS® 2.0 TPOT attempted to fill this gap and provide evidence of the validity and reliability of the revised instrument.

TEAM. As previously reported in Chapter Two, Cooper and colleagues (2010) reported significant validity and reliability assessment of the TEAM instrument. Content validity of the TEAM was assessed and authors reported item content validity index (I-CVI) greater than .83 on all items and a total scale content validity (S-CVI) of .96 (Cooper et al., 2010). Construct validity was assessed using factor analysis and varimax rotation. A single factor solution was described which explained 80.27% of the total variance with item loadings ranging from .64 to .88 (Cooper et al., 2010). Concurrent validity was evaluated by comparing global performance
scores and ratings on all eleven items. Significant, positive correlations between global scores and individual scores were reported ($p < .01$) (Cooper et al., 2010).

Cooper and colleagues (2010) also report internal consistency, inter-rater, and test-retest reliability of the TEAM. Internal consistency reliability was determined through the independent review of 56 video-recorded resuscitation team events by one researcher and yielded Cronbach’s alpha coefficient of .97. Follow up analysis of rating by three resuscitation instructors during ‘real time’ testing resulted in Cronbach’s alpha coefficient of .97 (Cooper & Cant, 2014). These findings support internal consistency reliability of the TEAM. Inter-rater reliability was established by the random selection of six resuscitation video-recordings and the level of agreement between two experts on the scale scores. The mean Intra-Class Correlation Coefficients for the TEAM items was .60 (Cooper et al., 2010). Retest scoring of six randomly selected resuscitation videos occurred six months after initial scoring by the same expert. The mean Intra-Class Correlation Coefficient for the TEAM items was .80 (Cooper et al., 2010) thereby establishing test-retest reliability.

Permission to Use Tool

**TeamSTEPPS® 2.0 TPOT.** The TeamSTEPPS® 2.0 TPOT is available to the public via the AHRQ website (AHRQ, 2014). The TeamSTEPPS® resources are free of charge. The use of TeamSTEPPS® resources is encouraged in an effort to advance the TeamSTEPPS® National Implementation Plan (Agency for Healthcare Research and Quality, 2013).

**TEAM.** Dr. Simon Cooper is the TEAM Project Director and Associate Professor of Nursing and Midwifery at Monash University in Victoria, Australia. He was contacted via email regarding the proposed research project and intent to use the TEAM instrument as a means of concurrent validity with the TPOT. He responded favorably stating, “you have our permission
to use TEAM and best of luck with your studies” (Cooper, personal communication, March 9, 2014).

**Summary**

This chapter described the methods used to conduct the study. Rationale and justification were provided to support the methods. Data collection and access to study participants were identified. The tools for data collection and procedures for exploring validity and reliability attributes of the TPOT were described. The study demonstrated a comprehensive research design in an effort to establish baseline psychometric properties of the TeamSTEPPS® 2.0 TPOT.
Chapter Four
Introduction

The purpose of this study was to establish baseline psychometric properties of the TeamSTEPPS® 2.0 TPOT. The Dickinson and McIntyre Teamwork Model served as the theoretical framework to guide the investigation. Validity of the TeamSTEPPS® 2.0 TPOT was determined through content, construct, and concurrent validity testing. Reliability was established by evaluation of internal consistency, inter rater, and test-retest reliability.

This chapter presents the results of the baseline psychometric assessment of the TeamSTEPPS® 2.0 TPOT. Seven team science experts established content validity by assessing the relevance of each TeamSTEPPS® 2.0 TPOT item. To evaluate construct validity, an item analysis and factor analysis using the maximum likelihood method with varimax rotation were conducted. Concurrent validity was determined by correlating TeamSTEPPS® 2.0 TPOT scores with TEAM scores. Internal consistency reliability was established by evaluating Cronbach alpha coefficients for the total TPOT scale and subscales. Inter-rater reliability was determined by calculating intra-class correlations of six randomly selected TeamsSTEPPS® trained healthcare professionals. Finally, the stability of the TeamSTEPPS® 2.0 TPOT was evaluated by conducting a test-retest procedure.

Results

Data Accuracy/Screening/Integrity

Data accuracy, screening, and integrity were evaluated and maintained throughout the study. Online participants entered responses directly into the Survey Monkey application at the time of TPOT and TEAM scoring. The Survey Monkey application was constructed using a 1 to 5 Likert scale that required participants to assign a score to all 23 TPOT items or all eleven TEAM items before advancing to the next page of the survey. Drop-down, whole number
options were utilized in an effort to avoid missed variables. Online participant data were visually screened for coding errors.

Group session participants completed TPOT and TEAM scoring using paper surveys. Group participant paper surveys were visually screened for coding errors. Group participant data were manually entered into Survey Monkey by the study researcher and visually screened for transcription errors.

Survey Monkey data were exported to a Microsoft® Excel computer file at the completion of data collection. The Excel file was imported to the IBM® SPSS® Statistics version 22 program. Once data were imported to SPSS® 22, data were visually screened for coding errors.

The integrity of data was ensured through the use of a password-protected computer for the maintenance of online study data and analyses. Paper copies of study data were secured in a locked file cabinet. Data collected were maintained in the original paper or digital form and any subsequent data analyses were saved using a unique digital file name thus maintaining study data in its original form.

The means and standard deviations of TPOT and TEAM scores were analyzed to determine distribution of scores. The mean TPOT score was 53.09 (SD = 24.34). The mean TEAM score was 26.75 (SD = 13.56). Evaluation of the TPOT (Figure 5) and TEAM (Figure 6) histograms revealed skewed data distributions.
Figure 5

*TPOT Histogram*

![TPOT Histogram Image]

Figure 6

*TEAM Histogram*

![TEAM Histogram Image]
To further evaluate and determine data distribution, Shapiro-Wilk tests were conducted to assess the normality of data. The Shapiro-Wilk test was significant for the TPOT and TEAM scores (TPOT df = 247, statistic .93, p < .01), (TEAM df = 247, statistic .94, p < .01). The significant values indicated a deviation from normality (Field, 2009). A lack of normality existed with the TPOT and TEAM scores therefore; non-parametric Spearman’s correlation coefficients instead of Pearson’s correlation coefficients were calculated for concurrent and test-retest analyses.

**Content Validity Expert Sample**

Seven team experts, including clinicians and researchers provided data related to content validity. A national representation of experts was achieved with participants residing in Georgia, Alabama, Ohio, and New York. The data indicated participants’ experience with team science ranged from 4 to 36 years. The average length of time professional responsibilities involved working in teams was 22.42 years (SD = 12.03).

**TeamSTEPPS® Sample**

A convenience sample of 51 TeamSTEPPS® trained healthcare professionals participated in the review and scoring of one to five team performance videos (Table 1). The majority of the sample was female (84.3%, n = 43) and White/Caucasian (43.1%, n = 47). The greatest majority of sample participants lived in the southeast (86.3%, n = 43) however, participants also resided in the northwestern and northeastern United States. More than one third of the sample was employed in their current position for 11 or more years (49%, n = 25) and held a doctoral degree (49%, n = 25). A large proportion of the study participants had less than one year experience with the TeamSTEPPS® curriculum (64.6%, n = 33). More than two thirds of the sample had no experience or were not currently responsible for performance based assessments (60.8%, n = 31).
### Table 1

**TeamSTEPPS Sample Demographics** ($N = 51$).

<table>
<thead>
<tr>
<th></th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>52.9</td>
<td>11.4</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>43</td>
<td>84.3</td>
</tr>
<tr>
<td>Male</td>
<td>8</td>
<td>15.7</td>
</tr>
<tr>
<td><strong>Race</strong></td>
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<td></td>
</tr>
<tr>
<td>White/Caucasian</td>
<td>47</td>
<td>92.1</td>
</tr>
<tr>
<td>Black/African American</td>
<td>2</td>
<td>3.9</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>State of Residence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Georgia</td>
<td>36</td>
<td>70.6</td>
</tr>
<tr>
<td>Alabama</td>
<td>7</td>
<td>13.7</td>
</tr>
<tr>
<td>Louisiana</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>New York</td>
<td>1</td>
<td>2.0</td>
</tr>
<tr>
<td>Ohio</td>
<td>4</td>
<td>7.8</td>
</tr>
<tr>
<td>Oregon</td>
<td>2</td>
<td>3.9</td>
</tr>
<tr>
<td><strong>Type of Program Employed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic</td>
<td>37</td>
<td>72.7</td>
</tr>
<tr>
<td>Industry</td>
<td>4</td>
<td>7.8</td>
</tr>
<tr>
<td>Inpatient</td>
<td>4</td>
<td>7.8</td>
</tr>
<tr>
<td>Outpatient</td>
<td>4</td>
<td>7.8</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>3.9</td>
</tr>
<tr>
<td><strong>Years Employed in Current Position</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5</td>
<td>15</td>
<td>29.4</td>
</tr>
<tr>
<td>6-10</td>
<td>11</td>
<td>21.6</td>
</tr>
<tr>
<td>11-20</td>
<td>10</td>
<td>19.6</td>
</tr>
<tr>
<td>20+</td>
<td>15</td>
<td>29.4</td>
</tr>
<tr>
<td><strong>Degree</strong></td>
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<td></td>
</tr>
<tr>
<td>Associate Degree</td>
<td>4</td>
<td>7.8</td>
</tr>
<tr>
<td>Baccalaureate Degree</td>
<td>5</td>
<td>9.9</td>
</tr>
<tr>
<td>Master’s Degree</td>
<td>17</td>
<td>33.3</td>
</tr>
<tr>
<td>Doctoral Degree</td>
<td>25</td>
<td>49.0</td>
</tr>
<tr>
<td><strong>TeamSTEPPS Experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1 year</td>
<td>33</td>
<td>64.6</td>
</tr>
<tr>
<td>1-3 years</td>
<td>9</td>
<td>17.7</td>
</tr>
<tr>
<td>4-5 years</td>
<td>5</td>
<td>9.9</td>
</tr>
<tr>
<td>6+ years</td>
<td>4</td>
<td>7.8</td>
</tr>
<tr>
<td><strong>Experience with Performance Based Assessment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Experience</td>
<td>12</td>
<td>23.5</td>
</tr>
<tr>
<td>Previous Experience/Not Currently</td>
<td>19</td>
<td>37.3</td>
</tr>
<tr>
<td>Currently Responsible</td>
<td>20</td>
<td>39.2</td>
</tr>
</tbody>
</table>
Content Validity Index

The purpose of content validity is to describe the degree to which an instrument has an appropriate set of items that reflect the full content of the construct domain being measured (Polit & Yang, 2016). Content validity is established by consulting with experts who most often are clinicians, theorists, researchers, or patients (Polit & Yang, 2016). Experts in this study were asked to rate each of the 23 TPOT items for relevance to TeamSTEPPS® constructs. The scale was constructed as follows: 1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, and 4 = highly relevant. An item-level content validity index (I-CVIs) was computed on each TPOT item as the proportion of experts who scored an item as a three or four. Polit and Beck (2006) suggested an I-CVI in excess of .78 translates to evidence of adequate item relevance. In addition, information from the I-CVIs can be used to calculate a scale-level content validity index (S-CVI). The preferred method is to compute the S-CVI as the average of all I-CVIs (Polit & Yang, 2016). It is proposed that S-CVI values of .90 or higher provide evidence of strong content validity of the overall scale (Polit & Yang, 2016).

Level of agreement was determined by calculating a content validity index (CVI) for each individual item (I-CVI) and the overall scale (S-CVI/Ave) based on the proportion of experts with a rating of three or more. All items except one had an I-CVI greater than .85 (Table 2), which is above the acceptable value of .78 (Polit & Beck, 2006). Item 1d includes patient and family as part of the team, had an I-CVI of .71. Because the I-CVI did not meet the minimum parameter of .78, item 1d was excluded from further analysis. The overall S-CVI/Ave was .95 (Table 2), which is beyond the acceptable value of .90.
Table 2

*Content Validity Index (N = 7).*

<table>
<thead>
<tr>
<th>Team Structure</th>
<th>I-CVI</th>
<th>S-CVI/Ave</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Assembles a team</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. Assigns or identifies team members’ roles/responsibilities</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>c. Holds team members accountable</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>d. Includes patients and families as part of the team</td>
<td>.71</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication</th>
<th>I-CVI</th>
<th>S-CVI/Ave</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Provides brief, clear, specific, and timely information to team members</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. Seeks information from all available sources</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>c. Uses check-backs to verify information that is communicated</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>d. Uses SBAR, call-outs, and handoff techniques to communicate effectively with team members</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Leadership</th>
<th>I-CVI</th>
<th>S-CVI/Ave</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Identifies team goals and vision</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. Uses resources efficiently to maximize team performance</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>c. Balances workload within the team</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td>d. Delegates tasks or assignments, as appropriate</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>e. Conducts briefs, huddles, and debriefs</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td>f. Role models teamwork behaviors</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Situation Monitoring</th>
<th>I-CVI</th>
<th>S-CVI/Ave</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Monitors the status of the patient</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. Monitors fellow team members to ensure safety and prevent errors</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>c. Monitors the environment for safety and availability of resources</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>d. Monitors progress toward the goal and identifies changes that could alter the plan of care</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>e. Fosters communication to ensure that team members have a shared mental model</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mutual Support</th>
<th>I-CVI</th>
<th>S-CVI/Ave</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Provides task-related support and assistance</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>b. Provides timely and constructive feedback to team members</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td>c. Effectively advocates for patient safety using the Assertive Statement, Two-Challenge Rule or CUS</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td>d. Uses the Two-Challenge Rule or DESC Script to resolve conflict</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>.95</td>
</tr>
</tbody>
</table>

**Construct Validity-Item Analysis**

The purpose of construct validity is to determine how well measures reflect the phenomena of study (Trochim, 2001). An initial assessment of construct validity involves item analysis. Item analysis includes the means and standard deviations of each TPOT item to
evaluate scoring tendencies. Next, a correlation matrix is reviewed to evaluate the correlation of items to one another. Ideally, items in the correlation matrix will correlate with one another fairly well but not perfectly (Field, 2009). Perfect correlation is also termed singularity and indicates repetitive items that should be deleted. Conversely, any variables that correlate highly with other variables indicate multicollinearity and should be deleted. Inter item correlations between .3 and .9 are acceptable (Field, 2009).

Item analysis was assessed on the 22 remaining TPOT items (excluding item 1d.). The mean item scores were relatively stable ranging from 1.74 ($SD = 1.06$) (item 3d) to a high mean score of 2.92 ($SD = 1.42$) (item 1a). Table 3 details the mean scores and standard deviation of each item.
Table 3

*Means and Standard Deviations of TPO*T* Items (N = 247).*

<table>
<thead>
<tr>
<th>Item</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Assembles a team</td>
<td>2.92</td>
<td>1.42</td>
</tr>
<tr>
<td>1b. Assigns or identifies team members’ roles and responsibilities</td>
<td>2.49</td>
<td>1.32</td>
</tr>
<tr>
<td>1c. Holds team members accountable</td>
<td>2.34</td>
<td>1.28</td>
</tr>
<tr>
<td>2a. Provides brief, clear, specific, and timely information to team members</td>
<td>2.47</td>
<td>1.31</td>
</tr>
<tr>
<td>2b. Seeks information from all available sources</td>
<td>2.34</td>
<td>1.19</td>
</tr>
<tr>
<td>2c. Uses check-backs to verify information that is communicated</td>
<td>2.27</td>
<td>1.23</td>
</tr>
<tr>
<td>2d. Uses SBAR, call-outs, and handoff techniques to communicate effectively with team members</td>
<td>2.20</td>
<td>1.25</td>
</tr>
<tr>
<td>3a. Identifies team goals and vision</td>
<td>2.18</td>
<td>1.21</td>
</tr>
<tr>
<td>3b. Uses resources efficiently to maximize team performance</td>
<td>2.41</td>
<td>1.27</td>
</tr>
<tr>
<td>3c. Balances workload within the team</td>
<td>2.70</td>
<td>1.27</td>
</tr>
<tr>
<td>3d. Delegates tasks or assignments, as appropriate</td>
<td>2.54</td>
<td>1.32</td>
</tr>
<tr>
<td>3e. Conducts briefs, huddles, and debriefs</td>
<td>1.74</td>
<td>1.06</td>
</tr>
<tr>
<td>3f. Role models teamwork behaviors</td>
<td>2.35</td>
<td>1.31</td>
</tr>
<tr>
<td>4a. Monitors the status of the patient</td>
<td>2.66</td>
<td>1.32</td>
</tr>
<tr>
<td>4b. Monitors fellow team members to ensure safety and prevent errors</td>
<td>2.54</td>
<td>1.32</td>
</tr>
<tr>
<td>4c. Monitors the environment for safety and availability of resources</td>
<td>2.47</td>
<td>1.33</td>
</tr>
<tr>
<td>4d. Monitors progress toward the goal and identifies changes that could alter the plan of care</td>
<td>2.38</td>
<td>1.26</td>
</tr>
<tr>
<td>4e. Fosters communication to ensure that team members have a shared mental model</td>
<td>2.34</td>
<td>1.25</td>
</tr>
<tr>
<td>5a. Provides task-related support and assistance</td>
<td>2.74</td>
<td>1.31</td>
</tr>
<tr>
<td>5b. Provides timely and constructive feedback to team members</td>
<td>2.26</td>
<td>1.24</td>
</tr>
<tr>
<td>5c. Effectively advocates for patient safety using the Assertive Statement, Two-Challenge Rule or CUS</td>
<td>1.83</td>
<td>1.16</td>
</tr>
<tr>
<td>5d. Uses the Two-Challenge Rule or DESC Script to resolve conflict</td>
<td>1.63</td>
<td>1.09</td>
</tr>
</tbody>
</table>

The correlation matrix was then examined. Inter-item correlations ranged from .39 to .88 (Table 4). The inter-item correlations were within the acceptable parameters between .3 and .9.

Therefore, multicollinearity and singularity were not evident within the matrix.
TESTING OF THE TPOT

Table 4

Correlation Matrix for the 22-item TPOT (N = 247).

|     | 1a  | 1b  | 1c  | 2a  | 2b  | 2c  | 2d  | 3a  | 3b  | 3c  | 3d  | 3e  | 3f  | 4a  | 4b  | 4c  | 4d  | 4e  | 5a  | 5b  | 5c  | 5d  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1a  | 1   | .82*| .76*| .79*| .76*| .71*| .72*| .79*| .71*| .78*| .79*| .70*| .55*| .74*| .79*| .71*| .77*| .75*| .76*| .60*| .71*| .75*|
| 1b  | .82 | 1   | .76 | .79 | .76 | .71 | .72 | .79 | .71 | .78 | .79 | .70 | .55 | .74 | .79 | .71 | .77 | .75 | .76 | .60 | .71 | .75 |
| 1c  | .84 | .74 | 1   | .75 | .76 | .76 | .76 | .80 | .80 | .80 | .81 | .81 | .59 | .74 | .78 | .78 | .83 | .84 | .82 | .81 | .78 | .80 |
| 2a  | .79 | .77 | .75 | 1   | .75 | 1   | .75 | .76 | .76 | .76 | .76 | .76 | .69 | .71 | .75 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 2b  | .79 | .77 | .75 | 1   | .75 | 1   | .75 | .76 | .76 | .76 | .76 | .76 | .69 | .71 | .75 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 2c  | .75 | .72 | .72 | .72 | 1   | .75 | .75 | .76 | .76 | .76 | .76 | .76 | .69 | .71 | .75 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 2d  | .75 | .72 | .72 | .72 | 1   | .75 | .75 | .76 | .76 | .76 | .76 | .76 | .69 | .71 | .75 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 3a  | .75 | .75 | .72 | .82 | 1   | .75 | .80 | .80 | .80 | .80 | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 3b  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | .80 | .80 | .80 | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 3c  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | .80 | .80 | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 3d  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | 1   | .80 | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 3e  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | 1   | 1   | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 3f  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | 1   | 1   | 1   | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 4a  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | 1   | 1   | 1   | 1   | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 4b  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 4c  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 4d  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 4e  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 5a  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 5b  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 5c  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| 5d  | .75 | .75 | .72 | .82 | 1   | .80 | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | .80 | .80 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |

*p < .05, **p < .01

Legend: 1a. Assembles a team; 1b. Assigns or identifies team members’ roles and responsibilities; 1c. Holds team members accountable; 2a. Provides brief, clear, specific, and timely information to team members; 2b. Seeks information from all available sources; 2c. Uses check-backs to verify information that is communicated; 2d. Uses SBAR, call-outs, and handoff techniques to communicate effectively with team members; 3a. Identifies team goals and vision; 3b. Uses resources efficiently to maximize team performance; 3c. Balances workload within the team; 3d. Delegates tasks or assignments, as appropriate; 3e. Conducts briefs, huddles, and debriefs; 3f. Role models teamwork behaviors; 4a. Monitors the status of the patient; 4b. Monitors fellow team members to ensure safety and prevent errors; 4c. Monitors the environment for safety and availability of resources; 4d. Monitors progress toward the goal and identifies changes that could alter the plan of care; 4e. Fosters communication to ensure that team members have a shared mental model; 5a. Provides task-related support and assistance; 5b. Provides timely and constructive feedback to team members; 5c. Effectively advocates for patient safety using the Assertive Statement, Two-Challenge Rule or CUS; 5d. Uses the Two-Challenge Rule or DESC Script to resolve conflict.
Construct Validity - Factor Analysis

Factor analysis is an analytic technique that permits the reduction of a large number of correlated variables to smaller clusters of related variables (Nunnally & Burnstein, 1994). Two common strategies for factor analysis include principle component and maximum likelihood factor analysis. Data reduction for a maximum likelihood factor analysis is achieved by explaining the maximum amount of common variance in a correlation matrix using the smallest number of explanatory constructs (Field, 2009). Factor analysis includes communality estimates, factor extraction, and factor rotation. Several factors must be considered: sample size, the measure of association, the independence of the measures, and the significance of the matrix (Nunnally & Burnstein, 1994).

Kaiser-Meyer-Olkin measure of sampling adequacy (KMO). The Kaiser-Meyer-Olkin measure of sampling adequacy represents the ratio of the squared correlation between variables to the squared partial correlation between variables (Field, 2009). The KMO statistic varies between zero and one. A value close to one indicates the patterns of correlations are relatively compact and so factor analysis should yield distinct and reliable factors. Values between .7 and .8 are good, values between .8 and .9 are great, and values greater than .9 are superb (Field, 2009). Kaiser-Meyer-Olkin measure of sampling adequacy for TPOT scores was .973. The finding suggests the sample was factorable and adequate to move forward with the factor analysis procedure (Field, 2009).

Bartlett’s test of sphericity. The Bartlett’s test of sphericity examines whether the diagonal items of the variance-covariance matrix are equal and that the off-diagonal items are approximately zero. Significance is sought with the Bartlett’s test and indicates the correlations are large enough to make the analysis meaningful and an identify matrix is not present (Field,
An identity matrix is a matrix whose diagonals are 1 and the off diagonals are 0 (Pett, Lackey, & Sullivan, 2003). Such a finding would indicate there are no interrelationships among items. The Bartlett’s test of sphericity aids in the analysis of an identity matrix (Pett, Lackey, & Sullivan, 2003). Bartlett’s test of sphericity for TPOT scores was significant ($\chi^2(231) = 7159.33, p < .001$), indicating that the correlations were large enough to be meaningful and an identity matrix was not present.

**Communalities.** The proportion of common variance present in a variable is known as the communality (Field, 2009). A variable that has no specific variance, or random variance, would have a communality of 1. A variable that shares none of its variance with any other variable would have a communality of 0. Common variance is of interest in factor analysis to determine how well items fit, or do not fit with the extracted factors. High communalities represent that the extracted factors account for a large proportion of a variable’s variance. Small communalities represent that variables do not fit well with the extracted factors and should possibly be removed from the analysis. The communalities for TPOT items ranged from .62 to .88 (Table 5). Communalities were within the acceptable parameter of .6 or higher (Field, 2009) further confirming each item shared some common variance with the extracted factors.
Table 5

Initial Communalities for 22 TPOT Items (N = 247.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Communality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Assembles a team</td>
<td>.79</td>
</tr>
<tr>
<td>1b. Assigns or identifies team members’ roles and responsibilities</td>
<td>.82</td>
</tr>
<tr>
<td>1c. Holds team members accountable</td>
<td>.78</td>
</tr>
<tr>
<td>2a. Provides brief, clear, specific, and timely information to team members</td>
<td>.85</td>
</tr>
<tr>
<td>2b. Seeks information from all available sources</td>
<td>.79</td>
</tr>
<tr>
<td>2c. Uses check-backs to verify information that is communicated</td>
<td>.77</td>
</tr>
<tr>
<td>2d. Uses SBAR, call-outs, and handoff techniques to communicate effectively with team members</td>
<td>.78</td>
</tr>
<tr>
<td>3a. Identifies team goals and vision</td>
<td>.80</td>
</tr>
<tr>
<td>3b. Uses resources efficiently to maximize team performance</td>
<td>.87</td>
</tr>
<tr>
<td>3c. Balances workload within the team</td>
<td>.83</td>
</tr>
<tr>
<td>3d. Delegates tasks or assignments, as appropriate</td>
<td>.88</td>
</tr>
<tr>
<td>3e. Conducts briefs, huddles, and debriefs</td>
<td>.62</td>
</tr>
<tr>
<td>3f. Role models teamwork behaviors</td>
<td>.80</td>
</tr>
<tr>
<td>4a. Monitors the status of the patient</td>
<td>.85</td>
</tr>
<tr>
<td>4b. Monitors fellow team members to ensure safety and prevent errors</td>
<td>.84</td>
</tr>
<tr>
<td>4c. Monitors the environment for safety and availability of resources</td>
<td>.84</td>
</tr>
<tr>
<td>4d. Monitors progress toward the goal and identifies changes that could alter the plan of care</td>
<td>.88</td>
</tr>
<tr>
<td>4e. Fosters communication to ensure that team members have a shared mental model</td>
<td>.84</td>
</tr>
<tr>
<td>5a. Provides task-related support and assistance</td>
<td>.85</td>
</tr>
<tr>
<td>5b. Provides timely and constructive feedback to team members</td>
<td>.75</td>
</tr>
<tr>
<td>5c. Effectively advocates for patient safety using the Assertive Statement, Two-Challenge Rule or CUS</td>
<td>.78</td>
</tr>
<tr>
<td>5d. Uses the Two-Challenge Rule or DESC Script to resolve conflict</td>
<td>.71</td>
</tr>
</tbody>
</table>

**Factor extraction.** The purpose of factor extraction is to determine if a factor is statistically important (Field, 2009). Eigenvalues provide a method for extracting factors. The eigenvalues of a data set demonstrate how evenly the variances of the correlation matrix are distributed (Field, 2009). Field (2009) recommends retaining all factors with eigenvalues greater than 1.
Two factors had eigenvalues of greater than one (16.32, 1.25). Initial eigenvalues of TPOT items indicated the first two factors explained 74% and 6% of the variance respectively (Table 6). The third, fourth, and fifth factors had eigenvalues less than one.

Table 6

*TPOT Factor Extraction (N = 247).*

<table>
<thead>
<tr>
<th>Factor Number</th>
<th>Eigenvalue</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16.32</td>
<td>74</td>
</tr>
<tr>
<td>2</td>
<td>1.25</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>.51</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>.45</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>.37</td>
<td>2</td>
</tr>
</tbody>
</table>

The scree plot is a graphic depiction of each eigenvalue against the factor with which it is associated (Field, 2009). Typically there are few factors with high eigenvalues and many factors with relatively low eigenvalues. The change in eigenvalues results in a characteristic shape when there is a sharp descent in the curve followed by a tailing off. The inflection of the curve is the cut-off point for selecting factors (Field, 2009). A review of the scree plot indicated an inflexion in the line after the second factor (Figure 7). These two factors accounted for 80% of the total variance in the TPOT construct.
Testing of the TPOT

Figure 7

Scree plot

Factor rotation. For the purpose of this study, it was assumed that factors were uncorrelated and therefore, an orthogonal rotation was used. Solutions were examined using the maximum likelihood extraction with varimax rotation of the factor-loading matrix. A factor matrix was explored with a two-factor solution as suggested by the interpretation of eigenvalues and the scree plot previously discussed.

Factor loadings. Factors are statistical entities that can be visualized as classification axes along which variables can be plotted (Field, 2009). Each axis on the graph represents a
factor, and then the variables that make up a factor can be plotted according to the extent to which they relate to a given factor. Ideally, variables have a large coordinate for one axis and a low coordinate for any other factor. Such an instance would suggest the particular variable related to only one factor. For orthogonal rotations, Comrey and Lee (1992) provide guidelines for item-to-factor loadings to help determine if an item should be included among those defining the factor: .45 is considered fair, .55 is considered good, .63 is considered very good, .71 is considered excellent.

The factor loadings for TPOT items are presented in Table 7. All items in this analysis had primary loadings over .55. Twenty items loaded greater than .71 to a particular factor, indicating an excellent factor loading. One item (5b. Provides timely and constructive feedback to team members) loaded at .65 on factor one indicating a very good loading. One item (3e. Conducts briefs, huddles, and debriefs) had a cross loading of .51 on factor one and .53 on factor two.
Table 7

**TPOT Varimax Rotated Factor Matrix (N = 247).**

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor One</th>
<th>Factor Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Assembles a team</td>
<td>.84</td>
<td>.24</td>
</tr>
<tr>
<td>1b. Assigns or identifies team members’ roles and responsibilities</td>
<td>.82</td>
<td>.32</td>
</tr>
<tr>
<td>1c. Holds team members accountable</td>
<td>.74</td>
<td>.45</td>
</tr>
<tr>
<td>2a. Provides brief, clear, specific, and timely information to team members</td>
<td>.83</td>
<td>.37</td>
</tr>
<tr>
<td>2b. Seeks information from all available sources</td>
<td>.80</td>
<td>.35</td>
</tr>
<tr>
<td>2c. Uses check-backs to verify information that is communicated</td>
<td>.74</td>
<td>.40</td>
</tr>
<tr>
<td>2d. Uses SBAR, call-outs, and handoff techniques to communicate effectively with team members</td>
<td>.71</td>
<td>.47</td>
</tr>
<tr>
<td>3a. Identifies team goals and vision</td>
<td>.72</td>
<td>.50</td>
</tr>
<tr>
<td>3b. Uses resources efficiently to maximize team performance</td>
<td>.81</td>
<td>.44</td>
</tr>
<tr>
<td>3c. Balances workload within the team</td>
<td>.85</td>
<td>.27</td>
</tr>
<tr>
<td>3d. Delegates tasks or assignments, as appropriate</td>
<td>.85</td>
<td>.36</td>
</tr>
<tr>
<td>3e. Conducts briefs, huddles, and debriefs</td>
<td>.51</td>
<td>.53</td>
</tr>
<tr>
<td>3f. Role models teamwork behaviors</td>
<td>.81</td>
<td>.26</td>
</tr>
<tr>
<td>4a. Monitors the status of the patient</td>
<td>.84</td>
<td>.35</td>
</tr>
<tr>
<td>4b. Monitors fellow team members to ensure safety and prevent errors</td>
<td>.84</td>
<td>.33</td>
</tr>
<tr>
<td>4c. Monitors the environment for safety and availability of resources</td>
<td>.83</td>
<td>.37</td>
</tr>
<tr>
<td>4d. Monitors progress toward the goal and identifies changes that could alter the plan of care</td>
<td>.81</td>
<td>.44</td>
</tr>
<tr>
<td>4e. Fosters communication to ensure that team members have a shared mental model</td>
<td>.82</td>
<td>.38</td>
</tr>
<tr>
<td>5a. Provides task-related support and assistance</td>
<td>.85</td>
<td>.35</td>
</tr>
<tr>
<td>5b. Provides timely and constructive feedback to team members</td>
<td>.65</td>
<td>.55</td>
</tr>
<tr>
<td>5c. Effectively advocates for patient safety using the Assertive Statement, Two-ChallengeRule or CUS</td>
<td>.33</td>
<td>.86</td>
</tr>
<tr>
<td>5d. Uses the Two-Challenge Rule or DESC Script to resolve conflict</td>
<td>.21</td>
<td>.85</td>
</tr>
</tbody>
</table>

_Cross loadings_. Ideally, an item will load significantly on a single factor (Pett, Lackey, & Sullivan, 2003). There are times however, when an item loads significantly on multiple factors. Item 3e (Conducts briefs, huddles, and debriefs) cross-loaded on factor one (.51) and factor two (.53). Pett and colleagues (2003) suggest placing the item with the factor that it most closely relates to conceptually. Further discussion of item 3e in relationship to interpretation and conceptual fit is discussed in the following section.
**Factor interpretation.** The interpretation of factors is a “poetic, theoretical, and inductive leap” (Pett, Lackey, & Sullivan, 2003, p. 210). The process of factor analysis reduces data in an attempt to organize similar variables. Once items are organized by factors it is necessary to assign a descriptive name that represents all items associated with each factor (Pett, Lackey, & Sullivan, 2003).

The original organization of the TPOT suggested a five-factor solution. The factors were organized according to the TeamSTEPPS® five program principles: Team Structure, Communication, Leadership, Situation Monitoring, and Mutual Support. In this study, factor analysis of the TPOT supports a two-factor solution. Nineteen items loaded on factor one and two items loaded on factor two (Table 8). One item cross-loaded (3e) on both factors.

The nineteen items included in factor one share a common conceptual theme. Each of the nineteen items included in factor one are characteristics of participative leadership. The definition of participative leadership is, “the shared decision making between a leader and their followers” (Lam, Huang, and Chan, 2015, p. 836). The TeamSTEPPS® curriculum seeks to flatten the healthcare hierarchy by empowering team members. Successful implementation of participative leadership results in motivated teams with improved performance (Randolph, 2000), the same goals of the TeamSTEPPS® curriculum. Characteristics of participative leadership include: leading by example, participative decision making, coaching, informing, and showing concern/interacting with team members (Bortoluzzi, Caporale, & Palese, 2014).

Evaluation of item loadings supports naming factor one, Participative Leadership. Because the items included in the factor conceptually describe characteristics of participatory leadership, this is an appropriate factor name and more accurately describes the phenomena being measured.
At this point, item 3e (Conducts briefs, huddles, and debriefs) was examined to determine if the item fit conceptually with other items in factor one. The TeamSTEPPS® 2.0 curriculum explores the concept of briefs, huddles, and debriefs in the Leading Teams module (AHRQ, 2015). Briefs are team meetings employed prior to a team event. The purpose of the brief is to define team roles, discuss the status of the patient, and anticipate issues that may arise that will affect the team performance (AHRQ, 2015). The huddle is a strategy used during a patient care event to adjust a plan of care already in place (AHRQ, 2015). A debrief is employed at the conclusion of a team event in an effort to summarize what occurred, discuss challenges encountered, and strategies for team improvement (AHRQ, 2015). Briefs, huddles, and debriefs are initiated by the team leader however, any member of the team is encouraged to utilize the strategies as needed. For this reason, item 3e was deemed conceptually congruent with other items in factor one.

Two items (5c and 5d) loaded on factor two. The items are: effectively advocates for patient safety using the Assertive Statement, Two-Challenge Rule, or CUS and Uses the Two-Challenge Rule or DESC Script to resolve conflict. The two remaining items share qualities related to Conflict Management. The two TPOT items in factor two involve advocacy, and conflict resolution. The Foundation Coalition (2001) identifies concepts related to conflict management skills. Conflict management encompasses skills related to conflict resolution, conflict communication skills (advocacy), and establishing a structure for management of conflict (conflict resolution). Conflict Management is therefore an appropriate title for the TPOT items related to factor two.
Table 8

*TPOT Item Factor Interpretation (N = 247).*

<table>
<thead>
<tr>
<th><strong>Factor One:</strong> Participative Leadership Subscale</th>
<th><strong>Factor Two:</strong> Conflict Management Subscale</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Assembles a team</td>
<td>• Effectively advocates for patient safety</td>
</tr>
<tr>
<td>• Assigns or identifies team members’ roles</td>
<td>using the Assertive Statement, Two-</td>
</tr>
<tr>
<td>and responsibilities</td>
<td>Challenge Rule or CUS</td>
</tr>
<tr>
<td>• Holds team members accountable</td>
<td>• Uses the Two-Challenge Rule or DESC</td>
</tr>
<tr>
<td>• Provides brief, clear, specific, and timely</td>
<td>Script to resolve conflict</td>
</tr>
<tr>
<td>information to team members</td>
<td></td>
</tr>
<tr>
<td>• Seeks information from all available sources</td>
<td></td>
</tr>
<tr>
<td>• Uses check-backs to verify information that</td>
<td></td>
</tr>
<tr>
<td>is communicated</td>
<td></td>
</tr>
<tr>
<td>• Uses SBAR, call-outs, and handoff techniques</td>
<td></td>
</tr>
<tr>
<td>to communicate effectively with team members</td>
<td></td>
</tr>
<tr>
<td>• Identifies team goals and vision</td>
<td></td>
</tr>
<tr>
<td>• Uses resources efficiently to maximize</td>
<td></td>
</tr>
<tr>
<td>team performance</td>
<td></td>
</tr>
<tr>
<td>• Balances workload within the team</td>
<td></td>
</tr>
<tr>
<td>• Delegates tasks or assignments, as appropriate</td>
<td></td>
</tr>
<tr>
<td>• Conducts briefs, huddles, and debriefs</td>
<td></td>
</tr>
<tr>
<td>• Role models teamwork behaviors</td>
<td></td>
</tr>
<tr>
<td>• Monitors the status of the patient</td>
<td></td>
</tr>
<tr>
<td>• Monitors fellow team members to ensure</td>
<td></td>
</tr>
<tr>
<td>safety and prevent errors</td>
<td></td>
</tr>
<tr>
<td>• Monitors the environment for safety and</td>
<td></td>
</tr>
<tr>
<td>availability of resources (e.g. equipment)</td>
<td></td>
</tr>
<tr>
<td>• Monitors progress toward the goal and</td>
<td></td>
</tr>
<tr>
<td>identifies changes that could alter the plan</td>
<td></td>
</tr>
<tr>
<td>of care</td>
<td></td>
</tr>
<tr>
<td>• Fosters communication to ensure that team</td>
<td></td>
</tr>
<tr>
<td>members have a shared mental model</td>
<td></td>
</tr>
<tr>
<td>• Provides task-related support and assistance</td>
<td></td>
</tr>
<tr>
<td>• Provides timely and constructive feedback</td>
<td></td>
</tr>
<tr>
<td>to team members</td>
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</table>
Internal Consistency Reliability

The purpose of internal consistency reliability is to evaluate the degree to which items on a scale measure the same construct (Henson, 2001). Internal consistency reliability evaluates the interrelatedness of test items. Items on a test should be highly interrelated because it is assumed individual items evaluate the same construct of interest. Correlations between test items should be high because it is theoretically assumed the construct of interest has been measured to a degree of consistency.

Cronbach’s alpha coefficient. Cronbach’s alpha coefficient is a measure of scale reliability that “is loosely equivalent to splitting data in two in every possible way and computing the correlation coefficient for each split” (Field, 2009, p.674). The greater the coefficient is to 1, the greater the reliability of the scale. A Cronbach’s alpha coefficient value of .7 to .8 is an acceptable value for scale reliability (Field, 2009). The internal consistency reliability of a scale can be explored from the perspective of the total scale (Cronbach’s alpha coefficient) as well as each individual item (Corrected item total correlations, Cronbach’s alpha if item deleted). The purpose of describing internal consistency for this study was to identify the reliability of the TPOT scale, subscales, and individual items. Cronbach’s alpha coefficient for the total scale was .98 (Table 9).

Corrected item total correlations. Corrected item total correlations were evaluated to examine the correlations between each item and the total score. Items correlating with the total score less than .3 means that the item does not correlate with the total score overall. Reviewing the corrected item-total correlations indicated that correlations ranged between .57 and .91.

Cronbach’s alpha if item deleted. Cronbach’s alpha if item deleted values were evaluated to determine if deleting any item would improve the internal consistency reliability of
the total scale and subscales. Review of the Cronbach’s alpha if item deleted values for the total scale did not support deleting any items from the TPOT.

As previously discussed, item 3e (conducts briefs, huddles, debriefs) cross-loaded on factor one and factor two. The cross loading of factor 3e during factor analysis raised suspicion of the factor influence on internal consistency reliability. For this reason internal consistency reliability analyses were conducted to confirm if 3e was more appropriately loaded to the Participative Leadership subscale (factor one) or the Conflict Management subscale (factor two). With 3e in the Participative Leadership subscale, the Cronbach’s alpha coefficient was .99 as opposed to .98 with the item deleted. The Cronbach’s alpha coefficient of the Conflict Management subscale improved from .90 without item 3e as opposed to .86 with item 3e. The findings support loading item 3e to the Participative Leadership subscale.

Table 9

<table>
<thead>
<tr>
<th></th>
<th>Cronbach’s alpha coefficient</th>
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</thead>
<tbody>
<tr>
<td><strong>Total Scale</strong></td>
<td>.98</td>
</tr>
<tr>
<td><strong>Participative Leadership Subscale</strong></td>
<td></td>
</tr>
<tr>
<td>With item 3e</td>
<td>.99</td>
</tr>
<tr>
<td>Without item 3e</td>
<td>.98</td>
</tr>
<tr>
<td><strong>Conflict Management Subscale</strong></td>
<td></td>
</tr>
<tr>
<td>With item 3e</td>
<td>.86</td>
</tr>
<tr>
<td>Without item 3e</td>
<td>.90</td>
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</tbody>
</table>

**Concurrent Validity**

The purpose of concurrent validity is to determine the degree to which scores on an instrument are correlated with an external criterion, or a gold standard, measured at the same time (Polit & Yang, 2016). Concurrent validity is often assessed when determining psychometric properties of a new instrument in an effort to provide evidence that the instrument
is measuring the construct it purports to measure. A correlation coefficient is evaluated to determine the strength of association, or relationship, between test scores of the new instrument to the scores of the comparable instrument. When scores are normally distributed a Pearson’s correlation coefficient is evaluated. When non-normality exists between scores, which is the case with TPOT and TEAM scores, a Spearman’s correlation coefficient ($r_s$) is evaluated. The significance value for Spearman’s correlation coefficient is equal or less than .05 (Field, 2009).

Correlations between TPOT scores to TEAM scores were reviewed to establish concurrent validity. The TEAM instrument was chosen because constructs similar to the TPOT are examined and psychometric properties have previously been described (Cooper, 2010). A strong, positive, significant relationship was found between TPOT scores and TEAM scores ($r_s = .930, p < .001$), indicating as TPOT scores increased, TEAM scores increased.

Test-retest Reliability

Test-retest reliability provides evidence of the stability of instrument scores over time. The purpose of evaluating test-retest reliability is to distinguish the true score variance from transient error that results from time-related fluctuations in raters. Such fluctuations may include mood, psychological states, or information gained between assessments (Polit & Yang, 2016). In order to assess test-retest reliability the same raters must repeat the measure at two different points in time. Similar to concurrent validity, correlation coefficients are sought between scores to determine the relationship between variables. The correlation coefficient calculated for normally distributed scores is the Pearson’s correlation coefficient. The correlation coefficient calculated for non-normally distributed scores is the Spearman’s correlation coefficient ($r_s$). The significance value for Spearman’s correlation coefficient is equal or less than .05 (Field, 2009).
In an effort to determine the stability of TPOT scores over time, test-retest reliability was evaluated. Eleven randomly selected study participants completed repeat TPOT scoring of the same team videos two weeks after completing initial scoring. Spearman’s correlation coefficients between test and retest scores were significant for three of the five videos reviewed (Table 10). These findings suggest the majority (60%) of TPOT scores remained stable over time.

Table 10

<table>
<thead>
<tr>
<th>Video</th>
<th>Spearman’s Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video One</td>
<td>.765**</td>
<td>.006</td>
<td>11</td>
</tr>
<tr>
<td>Video Two</td>
<td>.448</td>
<td>.167</td>
<td>11</td>
</tr>
<tr>
<td>Video Three</td>
<td>.698*</td>
<td>.017</td>
<td>11</td>
</tr>
<tr>
<td>Video Four</td>
<td>.505</td>
<td>.136</td>
<td>10</td>
</tr>
<tr>
<td>Video Five</td>
<td>.662*</td>
<td>.037</td>
<td>10</td>
</tr>
</tbody>
</table>

*Correlation is significant at the .05 level (2-tailed).
**Correlation is significant at the .01 level (2-tailed).

**Inter rater Reliability**

The purpose of inter-rater reliability is to evaluate the consistency of scores among different examiners. An intra-class correlation coefficient (ICC) is a variance decomposition method used to assess the portion of overall variance attributable to between-subject variability (Li & Li, 2003). Randomly selected cases are evaluated from the study population and raters are assumed to share common metric and homogeneous variance (Eye & Mun, 2005). A two-way random ICC is appropriate when each rater rated all cases and raters are a random selection from a population of interest (Eye & Mun, 2005). An ICC can be determined among a single observation, Single Measure ICC, or averaged observations, an Average Measure ICC (ICC/Ave). Finally, the level of agreement between raters must be identified. Absolute
Agreement is appropriate when disagreement is understood not only in terms of relative standings given to cases but also in absolute scores (Eye & Mun, 2005). If relative ratings among cases are the only thing that matters, ICC Consistency is appropriate. Established cutoffs for assessing agreement based on ICC values are as follows: poor for ICC values less than .40, fair for values between .40 and .59, good for values between .60 and .74, and excellent for values between .75 and 1.0.

Ratings from six participants were randomly selected to quantify the degree of agreement among TPOT raters. Three participants with less than three years experience with the TeamSTEPPS® curriculum and three participants with more than three years experience with the curriculum were chosen. Intra-class correlation coefficients using a two-way random effects model with an absolute agreement definition were explored in an effort to identify consistency in ratings.

Excellent agreement (ICC/Ave = .80) was observed among the six raters (Table 11). Fair agreement (ICC/Ave = .45) was observed among raters with less than three years experience with the TeamSTEPPS® curriculum. Good agreement (ICC/Ave = .68) was observed among raters with four or more years experience with the TeamSTEPPS® curriculum.

Table 11

<table>
<thead>
<tr>
<th>Intra-class Correlation Coefficient for Inter-Rater Agreement of TPOT Raters (N = 6).</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICC/Ave</td>
<td>LL</td>
</tr>
<tr>
<td>All raters (N = 6)</td>
<td>.80</td>
</tr>
<tr>
<td>Less than 3 years TeamSTEPPS experience (n = 3)</td>
<td>.45</td>
</tr>
<tr>
<td>More than 3 years TeamSTEPPS experience (n = 3)</td>
<td>.68</td>
</tr>
</tbody>
</table>
Summary

Multiple dimensions of validity and reliability of the TPOT have been explored. Content validity analysis supports the TPOT as a 22-item instrument. Factor analysis using the maximum likelihood method with varimax rotation suggests TPOT items be arranged between two factors. Twenty items should be included in the Participative Leadership subscale (factor one) and two items should be included in the Conflict Management subscale (factor two). Internal consistency reliability was highly acceptable for the total scale and subscales. Concurrent validity was established between TPOT scores and TEAM scores. Test-retest reliability among eleven participants suggests the majority of TPOT scores remained stable over time. Inter rater reliability among six random TPOT raters suggests excellent agreement in scoring tendencies, although fair among raters with less than three years experience and good among raters with four or more years experience with the TeamSTEPPS® curriculum. Discussion of findings, conclusions, and recommendations for future study of the TPOT are presented in Chapter Five.
Chapter Five
Introduction

This study explored the validity and reliability of the TeamSTEPPS® 2.0 Team Performance Observation Tool (TPOT). The TPOT is a 23-item instrument designed to measure the performance of a healthcare team. Validity of the TPOT was established by evaluating content, construct, and concurrent validity. Reliability of the TPOT was determined through internal consistency, test-retest, and inter rater reliability. In this chapter, a discussion of the study results and future recommendations are presented.

Research Questions

Question One

What is the content validity of the TeamSTEPPS® 2.0 TPOT among a sample of TeamSTEPPS® trained individuals?

Content validity findings. Content validity of the TPOT was explored among seven team experts. The sampling of experts was adequate with a group average of nearly 23 years team experience and a reasonable national geographic representation (Northeast, Midwest, and Southeast) of participants. A content validity index (CVI) was defined on the 23 scale items. Each individual item except one had an item CVI (I-CVI) greater than the acceptable value of .78. One item (1d. Includes patient and family as part of the team), had an I-CVI of .71. For this reason, the item was deleted from further statistical analysis. The overall scale CVI (S-CVI/Ave) was .95, beyond the acceptable value of .90.

Content validity interpretation. Several reasons are suspected for the low I-CVI of item 1d. First, the remaining TPOT items address tasks specific to healthcare providers engaged in the provision of care. Healthcare providers do not often perceive patients and family members
as active participants in the provision of care. Family-centered care has proven to improve patient outcomes (Knapp, 2006) but has also proven a challenge to implement (Institute of Medicine, 2001).

Second, the CVI may have been low on item 1d because the experts sampled may have strong opinions as to who is considered a member of the healthcare team. Old paradigms of healthcare education did not include integration of families to the healthcare team (Kreitzer, Kligler, & Meeker, 2009). It is therefore possible the experts sampled may have perceived less value in this item.

The third reason to explain this finding is that the item may hold little relevance in evaluating the performance of a healthcare team from a TeamSTEPPS® perspective. The TeamSTEPPS® 2.0 curriculum does not provide great detail regarding the integration of the patient and family to the healthcare team. Integration of the patient and family to the healthcare team is briefly mentioned in the Communication module of the program and TeamSTEPPS® strategies do not make direct reference of how to integrate the patient and family to the healthcare team. For these reasons it is not surprising the CVI of item 1d (Includes patient and family as part of the team) had a lower value than the remaining TPOT items.

**Question Two**

What is the construct validity of TeamSTEPPS® 2.0 TPOT data among a sample of TeamSTEPPS® trained individuals?

**Construct validity findings.** Construct validity of the TPOT was explored from multiple dimensions. The mean item scores and standard deviations of the remaining 22 TPOT items evaluated were relatively stable. The inter-item correlations were within the acceptable parameters between .3 and .9 indicating multicollinarity and singularity were not present.
between items. This finding suggests the 22 TPOT items evaluated different constructs of team elements.

Factor analysis was performed in an effort to reduce the individual items to smaller clusters of related variables or factors. The Kaiser-Meyer-Olkin of .973 was considered a superb indication that the sample was factorable to further explore item analysis. The Bartlett’s test of sphericity was significant ($X^2 (231) = 7159.33, p < .001$), indicating the correlations were large enough to be meaningful and an identity matrix was not present.

The communalities of TPOT items were identified to explore the common variance among items. High communalities were sought to determine how well the items fit with extracted factors. The communalities for TPOT items ranged from .62 to .88 which was within the acceptable parameter of .6 or higher. This finding suggested each item shared some common variance with the extracted factors.

Factor extraction was then performed to determine the number of statistically important factors present among the TPOT items. All factors with eigenvalues greater than one were maintained. The eigenvalues dropped off significantly after two indicating TPOT items clustered between two factors. The scree plot reinforced this finding from a graphical perspective as eigenvalues leveled-off after two factors.

Finally, the factor solution was explored using an orthogonal varimax rotation because it was assumed the factors were uncorrelated. All items had initial factor loadings over .55, which is considered good. Using the varimax rotation, twenty items loaded greater than .71 to a particular factor suggesting the item related only to one of the two factors. One item (5b. Provided timely and constructive feedback to team members) loaded .65 on factor one indicating a very good factor loading.
In the varimax rotation, one item (3e. Conducts briefs, huddles, and debriefs) had a cross loading of .51 on factor one and .53 on factor two. This finding suggested item 3e had a near-neutral loading between factor one and two. Further consideration was then given as to how briefs, huddles and debriefs aligned with the items loaded to factor one and factor two. It was determined item 3e was more representative of a leadership quality (factor one) than that of a conflict management strategy (factor two). Item 3e was therefore loaded to factor one.

**Construct validity interpretation.** Once the items were arranged between the two factors, the items were reviewed for thematic representation between the factors. Twenty items loaded to the first factor. These 20 factor one items shared qualities of leadership. What makes the TeamSTEPPS® curriculum unique is the emphasis on improving patient safety through the mutual support among team members and for this reason naming the factor Leadership would minimize this important concept. A more appropriate name for the factor is Participative Leadership. The concept of participative leadership involves a shared decision-making process between a leader and followers (Lam et al., 2015) which is congruent with the TeamSTEPPS® curriculum description of leadership. Within the curriculum, the idea of participative leadership allows responsibility for the group to be shared among members instead of a hierarchal leader. Participative Leadership aligns with the purpose of the TeamSTEPPS® program which serves to flatten the healthcare hierarchy in an effort to improve the quality of care delivered. Leadership is therefore not an individual responsibility but rather, a responsibility of all team members. The TeamSTEPPS® curriculum teaches that all members are empowered to assume the leadership role if needed.

The two remaining TPOT items share qualities related to Conflict Management. The two TPOT items in factor two are advocacy and conflict resolution. Roche and Teague (2012)
identify concepts related to conflict management skills. Conflict management encompasses skills concerned with conflict resolution, self-awareness about conflict modes, conflict communication skills (advocacy), and establishing a structure for management of conflict (conflict resolution). Conflict Management is therefore an appropriate title for the TPOT items related to factor two.

With only two items loading to the second factor, it was important to consider the significance of these items to the overall TPOT. Future study should be given to the TeamSTEPPS® curriculum and TPOT to increase the number of items related to conflict management on subsequent TPOT versions. Increasing the number of items would provide greater insight to learners’ conflict management skills and provide greater feedback to learners regarding skills in this domain.

**Question Three**

What is the internal consistency reliability of TeamSTEPPS® 2.0 TPOT among a sample of TeamSTEPPS® trained individuals?

**Internal consistency reliability findings.** Internal consistency reliability was explored to identify the degree to which TPOT items fit together conceptually. The TPOT total scale demonstrated excellent internal consistency with the Cronbach’s alpha coefficient ($\alpha$) for the total scale of .98. The Participative Leadership ($\alpha = .99$) and Conflict Management ($\alpha = .90$) subscales also demonstrated excellent internal consistency.

Corrected item correlations were between .57 and .91. This finding suggests the individual items correlated with the total score. Cronbach’s alpha if item deleted value was also reviewed to determine if any TPOT item should be deleted to strengthen the internal consistency of the scale. The Cronbach’s alpha if item deleted value did not support deleting any item from the TPOT further suggesting good internal consistency of TPOT items.
Internal consistency reliability interpretation. The internal consistency reliability of the TPOT suggests individual items conceptually fit together well. The Participative Leadership and Conflict Management subscales demonstrated excellent internal consistency. The differences between subscales may be a result of the Conflict Management subscale having only two items. Hinkin, Tracey, and Enz (1997) suggest four to six items for most constructs or conceptual dimensions. Adding two to four additional items to the Conflict Management subscale may increase the internal consistency of this factor. The need for additional Conflict Management subscale items further supports the need for additional study of the concept within the TeamSTEPPS® curriculum.

Question Four

What is the concurrent validity of the TeamSTEPPS® 2.0 TPOT when correlated with TEAM data?

Concurrent validity findings. The TEAM instrument was used to compare team performance scores in an effort to determine the validity of TPOT scores. The TEAM was chosen for several reasons. First, psychometric properties of the TEAM have been reported and data suggest the tool is valid and reliable (Cooper, 2010). Second, the TEAM and TPOT both measure similar phenomena, healthcare teams engaged in patient care. Third, authors of the TEAM instrument authorized the use of the instrument for this study (Cooper, 2014). A strong, positive, significant relationship was found between TEAM and TPOT scores ($r^2 = .930$, $p < .001$). This concurrent validity finding suggests as TEAM scores increased, TPOT scores increased.

Concurrent validity interpretation. The purpose of exploring concurrent validity in this study was to provide evidence that the TPOT is a reasonable instrument to evaluate healthcare
testing of the TPOT. Validity reporting of the TPOT is underreported and for this reason it was necessary to compare TPOT scores with a similar instrument whose psychometric properties have been established. The statistically significant correlations between TEAM and TPOT scores support the use of the TPOT as an effective instrument to evaluate team performance.

**Question Five**

What is the test-retest reliability of the TeamSTEPPS® 2.0 TPOT among a sample of TeamSTEPPS® trained individuals?

**Test-retest reliability findings.** The purpose of test-retest analysis is to determine the stability of instrument scores over time. Eleven randomly selected participants reviewed and scored five team performances approximately two weeks after the initial scoring of performances. The majority (60%) of scores were significant at the .01 level. The Spearman’s correlation coefficient was not statistically significant (.448) for the second video and (.505) the fourth video indicating the scores for the two videos were not consistent over time.

**Test-retest reliability interpretation.** Cherry (2015) suggests test-retest reliability is best used for phenomena that are stable over time and assumes that there will be no change in the quality or construct being measured. The raters’ understanding of TeamSTEPPS® concepts were expected to remain stable during the two weeks between assessments, and the order of team performance video review did not change between assessments. For these reasons, scores were expected to remain stable over time.

The instability of video two and video four scores may have occurred due to the order of performances reviewed. The performances in video one, video three, and video five were that of high functioning healthcare teams. The second and fourth performances were of lesser performing teams. Raters were not informed of the variability of performance prior to viewing
the videos. The unexpected change in performance quality may have confused raters resulting in scoring variability. Because the second review of videos occurred in the same sequence as the first, raters were aware of the quality of individual team performances related to each video on repeat testing and may have scored the performances differently based on their previous experience. While not all retest scores demonstrated significance, the majority of scores remained stable over time providing evidence of test-retest reliability.

**Question Six**

What is the inter rater reliability of the TeamSTEPPS® 2.0 TPOT among a sample of TeamSTEPPS® trained individuals?

**Inter rater reliability findings.** Six raters were randomly chosen to explore inter rater reliability due to the demographic findings of the study sample. The response from raters suggest a range of experience with the TeamSTEPPS® curriculum. For this reason, the Internal Consistency Coefficient (ICC) was explored. Fair to excellent agreement of scores was determined. Fair agreement (ICC/Ave = .45) was found among raters with less than three years experience with the curriculum. Good agreement (ICC/Ave = .68) was observed among raters with four or more years experience with the curriculum. The greatest agreement (ICC/Ave = .80) was among group scores as a whole.

**Inter rater reliability interpretation.** A fundamental principle in establishing the reliability of instrument scores is to ensure the reliability of scores among different raters (Field, 2009). Inter rater reliability assessment serves as a way to “calibrate” observers (Trochim, 2001). The greater variance in scores compared with more experienced raters may have resulted from an inexperience with TeamSTEPPS® concepts among novice raters. The scoring differences between groups suggests the need for additional TPOT training of raters beyond a
single TeamSTEPPS® workshop. Additional training of raters responsible for using the TPOT would help to “calibrate” raters and improve reliability of scores among rater groups.

**Discussion**

Polit and Beck (2012) suggest validity and reliability of an instrument must be examined and found acceptable before the beginning of data collection. The TeamSTEPPS® 2.0 TPOT was released in 2014 and a comprehensive psychometric evaluation of data has been underreported to date. Evaluating multiple perspectives of validity and reliability of TPOT data as described in this study, filled this knowledge gap.

Validity and reliability are intertwined concepts (Shelestak & Voshall, 2014). An instrument cannot be considered valid until it is reliable because “a test cannot do what it is supposed to do until it does what it is supposed to do consistently” (Salkind, 2012, p. 65). The 22-item TPOT can be used to evaluate the performance of healthcare teams because the instrument has been proven both valid and reliable. This new knowledge is significant for many reasons.

**Relevance to Theoretical Framework**

**Evidence to support the teamwork model.** The Dickinson and McIntyre Teamwork Model was chosen as the theoretical framework to support the study. The 23 TPOT items were situated within the framework prior to beginning the study. The TPOT concepts integrated well with the structure of the Teamwork Model. The Teamwork Model also explained the process of team performance in accordance with the TPOT perspective.

**Validity findings.** Content validity findings among seven team experts suggest 22 of the 23 TPOT items were relevant, further justifying use of the Teamwork Model. Concurrent validity findings provided additional evidence that the Teamwork Model was an appropriate
choice because TPOT scores were consistent with TEAM scores. The validity findings indicate the TPOT is an appropriate scale to measure team performance.

**Reliability findings.** Internal consistency reliability findings support the conceptual fit of TPOT items within the scale indicating individual items are consistent with team behaviors. Test retest reliability findings suggest TPOT scores are stable over time providing evidence that teamwork was measured on repeat assessment. Inter rater reliability findings suggest TPOT scores were stable between multiple raters this finding indicates that more than one rater agreed on the team assessment. The reliability findings of the study support the use of the Dickinson and McIntyre Teamwork Model as the theoretical framework of choice for the study.

**Evidence to support alternative models.** Significant evidence exists to support the use of the Dickinson and McIntyre Teamwork Model for the study however; consideration for the choice of an alternative theoretical framework must be discussed. Seven team concepts are defined in the Dickinson and McIntyre Teamwork Model. The seven concepts are: Communication, Team Orientation, Team Leadership, Monitoring, Feedback, Backup, and Coordination. The original TPOT is organized among five concepts. The five concepts are: Team Structure, Communication, Leadership, Situation Monitoring, and Mutual Support. Backup behaviors are imbedded in the Mutual Support domain of the TPOT. Coordination was embedded in the team structure, leadership, situation monitoring, and mutual support domains. The Teamwork Model and TPOT items were situated between seven and five factors therefore, it was anticipated at least five factors would emerge during factor analysis.

**Construct validity findings.** Construct validity findings suggest two factors are present within the TPOT. The majority of items (91%, n = 20) loaded strongly to the first factor and only two items (5%, n = 2) loaded to the second factor. Items in factor one contain elements of
Participative Leadership and items in factor two contain elements of Conflict Management. It would therefore be appropriate to consider a leadership theory that combines elements of participative leadership and conflict management as the theoretical framework for future TPOT studies.

**Conflict management and the TPOT.** Construct validity findings suggest two TPOT items loaded to the Conflict Management factor. With only five percent of items loading to the Conflict Management factor, future study should include adding items to the TPOT in an effort to strengthen the evaluation of conflict management skills. Additional assessment of conflict management skills will give a greater perspective of how teams manage conflict as well as provide evidence of the depth to which the TeamSTEPPS® curriculum addresses this concept. Study findings support updating the TeamSTEPPS® curriculum to include a greater emphasis on conflict management skills.

**Relevance to Nursing Practice**

**Patient safety.** Study findings support the use of the TPOT to improve patient safety. The validity and reliability of the instrument for evaluation means TeamSTEPPS® training programs can utilize the TPOT as a metric of team performance. The TPOT scores can quantify healthcare members’ team skills in direct relation to the curriculum. Teams can utilize TPOT scores to appreciate strengths and areas of weakness to improve upon. The tracking of PAEs can be monitored and correlated with TPOT scores to demonstrate improved patient safety.

**TeamSTEPPS® national implementation plan.** In accordance with the National Implementation Plan of TeamSTEPPS® training, efforts to flatten the healthcare hierarchy can continue and advance through the use of a valid and reliable performance measure. Trainers and participants can utilize TPOT scores to better understand the effectiveness of team training.
Scenarios can be designed and implemented that challenge the training participants in key concepts such as participative leadership and conflict management skills. The performance during the scenarios can be quantified, reviewed, and repeated to strengthen team skills. Healthcare organizations can proceed with confidence that TPOT scores are valid and reliable.

Relevance to Nursing Education

National nursing organization initiatives. Several positive impacts to nursing education can be realized through the findings of this study. Recommendations set forth by the AACN, NLN, and QSEN are realized through TeamSTEPPS® training initiatives. Prior to this study, performance measures that directly relate to the TeamSTEPPS® curriculum were not available. The only psychometrically sound instruments related to the TeamSTEPPS® curriculum were attitude assessments and institutional team culture assessments. Educators now have evidence of a performance instrument that is valid and reliable which can be used to support the advancement of team skills. Contemporary nursing practice calls for nurses to possess effective team skills. Use of the TPOT, which has now been proven valid and reliable, in nursing education aligns with national nursing organization initiatives.

Evidence of team performance. Evaluating the effectiveness of nursing students’ team skills requires valid and reliable instruments to quantify team performance. Study findings suggest the TPOT can be utilized to evaluate the performance of students’ team skills. Students’ abilities to work in teams can be evaluated using the TPOT from a formative or summative perspective. Nurse educators can utilize the TPOT throughout undergraduate and graduate nursing programs in an effort to appraise learners working in teams.

Transition to practice. Scores from the TPOT can inform students of their team skills before entry to practice. Students can seek opportunities to strengthen their team skills and
pursue opportunities during practical experiences to improve their team skills prior to graduation. Students who have experienced team performance evaluation during their training can enter the workforce better prepared to immediately function as an effective member of the healthcare team. Overall, study findings strengthen nursing education by providing a valid and reliable tool educators can use to improve the evaluation of students in an effort to maintain the quality of graduates.

Relevance to Nursing Research

Simulation pedagogy. The simulation pedagogy is strengthened as a result of the study findings. The study utilized the performance of five healthcare teams engaged in a simulated critical patient care event. The reproducibility and fidelity ensured study participants were able to experience a simulated patient event and score the response of the healthcare team using TeamSTEPPS® strategies. This study moved beyond an evaluation of students’ attitudes toward the simulated clinical environment to an assessment of performance in the environment. The simulation pedagogy can continue to mature because team skills can be quantified by the TPOT to provide evidence that the simulated learning environment is a safe and reproducible environment to refine team performance.

Team science. Establishing the psychometric properties of the TPOT has advanced the science of teams. Researchers can utilize the TPOT to quantify team performance in an effort to better understand how individuals work together in relation to TeamSTEPPS® skills. The TPOT can be used to score team skills before and after interventions. The TPOT can also be used to evaluate team skills over time with repeated measures.

Study design. Nursing research is strengthened through the design of this study. TeamSTEPPS® trained individuals took part in an investigation evaluating healthcare teams. The
participants were exposed to the process of establishing validity and reliability of team performances. Participants may go on to create similar studies related to TeamSTEPPS® training and or psychometric testing of other performance-based instruments.

**Relevance to Healthcare**

**Improved multidisciplinary teams.** Findings from this study extend beyond nursing to healthcare at large. Today’s healthcare is provided in a multidisciplinary arena. For this reason, it is important to seek knowledge that will apply to providers across disciplines. The impetus for the creation of the TeamSTEPPS® program was to improve the quality of healthcare provided by strengthening the healthcare team. This study provides evidence of a valid and reliable instrument to quantify team performance directly related to TeamSTEPPS® strategies. The quality of healthcare teams can expect to improve through the use of TPOT scores, as participants can be confident the instrument is valid and reliable.

**Improved healthcare quality.** Using the TPOT to improve healthcare teams means high functioning teams can positively impact healthcare costs by providing safer and more efficient care. Patients can expect fewer medical errors that as of 2008, were in excess of $19.5 billion a year (Andel et al., 2012). Knowledge from this study can positively influence healthcare because healthcare teams can improve performance, decrease errors and improve the overall quality of care delivered.

**Limitations**

**Sample population.** Several limitations to the study must be identified. The study sample population was young in terms of exposure to the TeamSTEPPS® curriculum. A majority of the sample (82.3%, n = 51) had less than three years experience with the TeamSTEPPS® curriculum. This limitation is further supported by the fair inter rater reliability
findings among the three year group. Invitation was extended to more than 500 TeamSTEPPS® trained individuals through personal communication, email communication, and professional social media (LinkedIn) strategies. Survey Monkey data indicated 72 individuals viewed the survey however; only 51 individuals viewed and scored the team performances. This lack of participation required a TeamSTEPPS® training initiative to recruit study participants. Thirty-three participants were recruited in this manner. The variability of scoring among newly trained TeamSTEPPS® participants suggest training beyond the initial workshop may be needed to refine rating skills and improve scoring tendencies.

Prior TeamSTEPPS® knowledge. A second study limitation was that participants’ understanding of TeamSTEPPS® concepts were not evaluated prior to participation in the study. Determining the level of TeamSTEPPS® knowledge prior to participation in the study may have excluded participants. Recruitment efforts were a challenge and adding TeamSTEPPS® knowledge assessment may have excluded participants and further limited recruitment efforts. Exploring the inter rater reliability attempted to overcome this limitation. Inter rater reliability was established therefore; an attempt was made to mitigate this limitation.

Data collection. A third study limitation related to the method of data collection. Eighteen participants completed the evaluation and scoring of team performances independently online while forty-two participants completed the evaluations and scoring in face-to-face group sessions. Independent raters may have encountered frequent distractions that could have impacted the consistency of scoring tendencies. The length of video review could not be controlled with online participants. The Vimeo website utilized to stream the team performance videos allowed for rewind, pause, and fast-forward viewing. Online participants could have sped through the video review missing important moments in the performance. Conversely, the video
review in face-to-face group sessions was controlled. A limitation to the face-to-face group data collection sessions was that verbal and non-verbal communication between participants was difficult to control. The researcher instructed participants to avoid verbal and non-verbal communication prior to data collection in an effort to standardize the experience.

**Instrument fatigue.** A fourth study limitation included the potential for instrument fatigue. Each study participant was asked to view five, ten-minute team videos and score each performance with two instruments. Approximately sixty minutes were required to complete the video review and scoring. The time commitment to participate in the study is a likely reason for the poor response rate among previously trained TeamSTEPPS® individuals. The attrition from 74 individuals who consented to participate in the study and only 51 participants who completed video scoring supports this position.

**Team performance video sequencing.** A fifth study limitation involves the sequencing of team videos. Five team performances demonstrating various levels of performance were utilized for the study. The video sequencing remained constant throughout the study and were arranged as follows: end of course (video one), middle of course (video two), end of course (video three), beginning of course (video four), and end of course (video five). Study participants may have anticipated the performances would progressively improve with subsequent videos. The sequencing was chosen to improve the sensitivity of scoring however; this limitation may explain why the test-retest scores related to videos two and four were not significant.

**Recorded team performances.** A sixth study limitation involves the recorded team performances. The five video recordings were of pre-licensure nursing students. The students were learners with limited experience with healthcare teams. While several performances
demonstrated a high functioning team, the teams were not multidisciplinary and lacked significant experience in the practice environment. The variability in performance did however allow for variability in scoring. The variability in scoring concurred with TEAM scores suggesting this limitation did not significantly impact TPOT scores.

Overall, there were several limitations inherent with the study. Rationale for each limitation has been presented. Recommendations for future study include strategies to minimize these study limitations.

**Recommendations**

**TPOT Version 3.0**

Study findings suggest the TeamSTEPPS® 2.0 TPOT should be revised and should be titled the TPOT 3.0. Study findings support 22 items to be included arranged between two factors. Twenty items relate to the Participative Leadership subscale and two items relate to the Conflict Management subscale. The scoring of items should include an absolute zero to address instances when the specific item is not present in the scenario. Though outside the realm of this body of work, a comprehensive scoring handbook should be provided to ensure standardization of scoring. The scoring should clearly instruct if subscale scores are to be totaled or averaged. The total scoring should also indicate if the value should be the sum of all scores or an average of overall team performance. Raters should be advised to evaluate the performance of the team and not individual performances of team members. The TPOT 3.0 and scoring handbook should be easily available and free of charge consistent with current TeamSTEPPS® resources. Modifying the TPOT from its current state and providing an easily accessible scoring handbook, would result in convenient access to these important resources for standardizing the measurement healthcare team performances.
Testing the TPOT 3.0

Repeat psychometric testing of the TPOT 3.0 should occur because scale development is a multi-step iterative process. Multiple TeamSTEPPS® experienced raters evaluating multiple team scenarios should take place to establish psychometric properties of the TPOT 3.0. The team scenarios should involve multidisciplinary healthcare teams. Researchers should seek TeamSTEPPS® trained individuals with at least three years experience with the curriculum in an effort to establish significance in scoring tendencies among raters. Face-to-face group data collection sessions should occur to efficiently obtain TPOT 3.0 scores. Online data collection should be avoided, as the attrition was high using this strategy. Retest assessments should occur with experienced raters. Great promise exists to establish the validity and reliability of the TPOT 3.0 with repeat psychometric testing.

Future Study

**Academic environment.** Future research should utilize the TPOT 3.0 in the academic environment. Studies should explore the performance of teams in pre-licensure and graduate programs using the TPOT 3.0. The simulated clinical environment should be utilized for training in both groups as mannequin fidelity allows for the creation of scenarios that mimic the practice setting without harming patients. Researchers should utilize identical simulated patient care scenarios between pre-licensure and graduate learner groups to compare scores in an effort to better understand the two groups. Future study should also include pre-licensure and graduate learners working in interprofessional groups to expose learners to various team roles and responsibilities. Scenarios should be created that include the emergence of team struggle in an effort to provide opportunities that require conflict management strategies. Inclusion of pre-licensure and graduate students in simulated scenarios will benefit both groups simultaneously.
by increasing exposure to interprofessional learning, while simultaneously providing evidence to learners and programs of the effectiveness of training initiatives.

**Practice environment.** Healthcare is delivered in a multidisciplinary environment and for this reason multidisciplinary teams should be sought in all instances of TeamSTEPPS® training in the practice setting. Training initiatives should occur in the simulated learning environment allowing replication of scenarios among multiple learners without risking patient harm. All members of the healthcare team should be included in training sessions in an effort to improve interprofessional education and strengthen teams.

**Impact of training long term.** Future study of the TPOT 3.0 should include the evaluation of TeamSTEPPS® training long term. Limited data are available as to the impact of TeamSTEPPS® training over time. Longitudinal assessments are difficult to obtain due to the time and resources required for such studies. Staff turnover and variability of teams are additional challenges to evaluating the impact of team training on team performance. While inherent challenges exist with longitudinal assessments, such studies are valuable as findings would lead to a greater knowledge of the effect of TeamSTEPPS® training on performance over time. Administrators in both the academic and practice environments would have evidence to support the allocation of funding for such training. The TeamSTEPPS® curriculum would be strengthened by studies that explore the performance of teams over time to determine efficient training schedules for participants.

**Summary**

The preceding pages described the study design, data collection, and data analysis to establish baseline psychometric properties of the TPOT. The validity and reliability of the TPOT has been defined. The significance of the study findings to the Dickinson and McIntyre
teamwork theoretical model, nursing practice, nursing education, nursing research, and healthcare have been appreciated. An updated version of the TPOT instrument has been proposed along with recommendations for future study. Healthcare providers can proceed with confidence using the 22-item TPOT to evaluate the performance of healthcare teams. With the use of performance measures and a continued commitment to the improvement of healthcare teams, PAEs can expect to decrease which will lead to an improvement in healthcare quality. The healthcare community owes it to people like Susan Sheridan to make this a reality.
References


Team effectiveness and decision making in organizations (pp.333-380). San Francisco: Jossey-Boss.


Clapper, T.C., & Kong, M. (2012). TeamSTEPPS®: The patient safety tool that needs to be implemented. Clinical Simulation in Nursing, 8, 367-373.


PR Newswire. (2013). Boston children’s hospital study shows significant reduction in hospital medical errors with improved handoff communication. DOI:
201312031600PR.NEWS.USPR.DC26911

PR Newswire. (2014). TeamSTEPPS 2.0 updates, streamlines well-known patient safety training curriculum. DOI: 201403261657PR.NEWS.USPR.DC91765


http://www.who.int/patientsafety/information_centre/interviews/sheridan/en/
Figure 1. TeamSTEPPS® 2.0 Team Performance Observation Tool.
Figure 2. Team Emergency Assessment Measure. Printed with permission from Cooper, S.

Team Emergency Assessment Measure (TEAM)

Introduction
This form has been designed as a teamwork observational scale to assess the performance of emergency medical teams (e.g., resuscitation and trauma teams). The form should be completed by expert clinicians to enable accurate performance rating and feedback of leadership, teamwork, situation awareness and task management. Rating prompts are included where applicable. Please rate the first 11 items using the following scale and the last item using the 10 point scale.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Never/Hardly ever</th>
<th>Seldom</th>
<th>About as often as not</th>
<th>Often</th>
<th>Always/Nearly always</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Team Identification
Date_________________________Time_________________________Place_________________________
Team Leader_________________________Team_________________________

Leadership: It is assumed that the leader is either designated, has emerged, or is the most senior – if no leader emerges allocate a ‘0’ to questions 1&2.

1. The team leader let the team know what was expected of them through direction and command

2. The team leader maintained a global perspective
   - Prompts: Monitoring clinical procedures and the environment?
   - Remaining ‘hands off’ as applicable? Appropriate delegation?

Team Work: Ratings should include the team as a whole i.e. the leader and the team as a collective (to a greater or lesser extent).

3. The team communicated effectively
   - Prompts: Verbal, non-verbal and written forms of communication?

4. The team worked together to complete tasks in a timely manner

5. The team acted with composure and control
   - Prompts: Applicable emotions? Conflict management issues?

6. The team morale was positive
   - Prompts: Appropriate support, confidence, spirit, optimism, determination?

7. The team adapted to changing situations
   - Prompts: Adaptation within the roles of their profession?
   - Situation changes: Patient deterioration? Team changes?

8. The team monitored and reassessed the situation

9. The team anticipated potential actions
   - Prompts: Preparation of defibrillator, drugs, airway equipment?

Task Management

10. The team prioritised tasks

11. The team followed approved standards/guidelines
   - Prompts: Some deviation may be appropriate?

Overall

<table>
<thead>
<tr>
<th>Rating</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
</table>

12. On a scale of 1-10 give your global rating of the team’s performance

Comments:

________________________________________________________________________________________

________________________________________________________________________________________
Figure 3. Dickinson & McIntyre Teamwork Model
Figure 4. TPOT concepts embedded with Teamwork Model
# Team Performance Study Methods

## Evidence Table

### Pre-licensure

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Method</th>
<th>Participants</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interprofessional clinical training for undergraduate students in an emergency department setting</td>
<td>Ericson, A., Masiello, I., &amp; Bolinder, G. (2012)</td>
<td>Descriptive/exploratory, convenience sample (N=234) Questionnaire pre and post simulation experience to explore students’ attitudes regarding training experience using Likert scale &amp; open ended questions</td>
<td>Undergraduate nursing students, medical students, physiotherapy students</td>
<td>Majority of participants had a positive attitude toward training before and after experience Improved knowledge of other professions</td>
</tr>
<tr>
<td>An Interprofessional communication training using simulation to enhance safe care for a deteriorating patient</td>
<td>Liaw, S.Y., Zhou, W.T., Lau, T.C., Siau, C., &amp; Chan, S.W. (2014)</td>
<td>Descriptive/exploratory, convenience sample (N=127) Questionnaire pre and post simulation to explore student confidence &amp; perception of interprofessional learning End of session Satisfaction with Simulation Experience Scale (SSES)</td>
<td>Nursing students &amp; medical students</td>
<td>Both groups demonstrated improvement in self-confidence and perception of Interprofessional learning Overall participants reported satisfaction with training program</td>
</tr>
<tr>
<td>Preparation for becoming members of health care teams: findings from a 5-year evaluation of a student interprofessional training ward</td>
<td>Pelling, S., Kalen, A., Hammar, M. &amp; Wallstrom, O. (2011)</td>
<td>Descriptive/exploratory, convenience sample (N=919) Questionnaire to explore insight into participants’ professional role, other student’s professional roles and value of teamwork in health</td>
<td>Nursing students, medical students occupational therapy students, physical therapy students</td>
<td>Nursing students evaluated effects of their own professional role significantly higher than other student groups Insight into other professional roles had been strengthened Insight into the value</td>
</tr>
</tbody>
</table>
## Practice

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Method</th>
<th>Participants</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient safety improvement through in situ simulation interdisciplinary team training</td>
<td>Klipfel, J.M., Carolan, B.J., Brytowski, N., Mitchell, C.A., Getman, M.T., &amp; Jacobson, T.M. (2014)</td>
<td>Descriptive/exploratory convenience sample (N=23)</td>
<td>Registered nurses &amp; urology residents</td>
<td>Improved MHPTS scores post simulation Note: Participants found the experience useful, the scenario realistic and debriefing enhanced learning</td>
</tr>
<tr>
<td>Effect of obstetric team training on team performance and medical technical skills: a randomized controlled trial</td>
<td>Fansen, A.F., van de Ven, J., Merien, A., de Wit-Zurendonk, L., Houterman, S., Mol, B., Oei, S. (2012)</td>
<td>Randomized controlled, (N=24 hospitals)</td>
<td>Registered nurses, nurse midwives, residents, &amp; gynecologists</td>
<td>Participants in the training (treatment) group demonstrated significantly improved performance overall when compared with the control group</td>
</tr>
<tr>
<td>Teamwork in the trauma room evaluation of a multimodal team training program</td>
<td>Peckler, B., Prewett, M.S., Campbell, T., &amp; Brannick, M. (2012)</td>
<td>Descriptive/exploratory (N=41)</td>
<td>Residents</td>
<td>Situational Judgment scores statistically improved after training Note: Positive reaction by participants to training was reported</td>
</tr>
<tr>
<td>Is there an association between implementation of a medical team</td>
<td>Pawlik, T., M., Urbach, D.R., Halverson, A.L. (2013)</td>
<td>Retrospective descriptive Convenience sample (N=105 facilities)</td>
<td>Registered nurses, surgeons &amp; anesthesiologists</td>
<td>18% reduction in annual mortality in trained facilities</td>
</tr>
</tbody>
</table>
74 facilities partook in a 1-day team training and 4 quarterly structured telephone interviews
Main outcome measure: postoperative mortality

Impact of an embedded simulation team training programme in a pediatric intensive care unit: a prospective, single-center, longitudinal study
Prospective, single-center, longitudinal study (N=219)
Participants’ evaluation questionnaires over 3 phases of training (introductory-first 6 months, intermediate-second 6 months, established-second year)
Registered nurses, cardiologists, intensivists, anesthetists, surgeons, allied health professionals
Overall participants reported an effective impact on practice, non-technical and technical skills
Longitudinal step-wise significance in confidence reported by participants

Practice Setting

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Method</th>
<th>Participants</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>OB: Retention of factual knowledge after practical training for intrapartum emergencies</td>
<td>Crofts, J.F., Fox, R., Draycott, T.J., Winter, C., Hunt, L.P., &amp; Akande, V.A. (2013)</td>
<td>Multi-site, prospective randomized-controlled (N=150) Random recruitment among facilities underwent training at home facility or simulation center with or without additional teamwork training Pre-post training questionnaire (knowledge measure)</td>
<td>Nurse midwives &amp; physicians</td>
<td>Mean scores remained higher than before training but slightly lower than immediately after training—suggests some loss of knowledge over time Type of training had no effect on retention of knowledge</td>
</tr>
<tr>
<td>OB: Introducing an obstetric emergency training strategy into a simulated environment</td>
<td>Hughes, C., Anderson, G., Patterson, D., &amp; O’Prey, M. (2014)</td>
<td>Descriptive/exploratory (N=34) Team training lectures, case studies, simulation regarding obstetric emergencies Questionnaire modified from Lander (2008) to assess reaction, learning, transfer and results (knowledge and perception measure) Focus groups (perception measure)</td>
<td>Midwifery students</td>
<td>Questionnaire results: 93% of participants appreciated working in a team. 90% believed the training increased their team working skills Focus group data findings: increased self-awareness after training, identified the importance of reflection and feedback from both peers and instructors, positive learning experience through the safe environment of simulation</td>
</tr>
<tr>
<td>ER: Reliability of team-based self-</td>
<td>Stocker, M., Menadue,</td>
<td>Descriptive exploratory Convenience sampling (N=105 participants, 58</td>
<td>Registered nurses, physicians,</td>
<td>MHPTS: overall Cohen’s kappa &gt;0.8 on 6/16 items, kappa &gt;0.6 on 3/16 items</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>PICU: Improving teamwork, confidence, and collaboration among members of a pediatric cardiovascular intensive care unit multidisciplinary team using simulation-based team training</td>
<td>Figueroa, M.I., Sepanski, R., Goldberg, S.P., &amp; Shah, S. (2013)</td>
<td>Descriptive/exploratory, repeated measure convenience sample (N=37)</td>
<td>Survey before training, immediately after training, 3 months post training participation evaluated perception of skill, knowledge and confidence (perception measure)</td>
<td>Significant increase in confidence, skill in the roles of team leader, advanced airway management, and cardioversion/defibrillation immediately after training and 3 months later</td>
</tr>
<tr>
<td>Rapid Response: The effectiveness of combined training modalities on neonatal rapid response teams</td>
<td>Kilday, D., Spiva, L., Barnett, J., Parker, C., &amp; Hart, P. (2013)</td>
<td>Quasi-experimental, pre-test/post-test, simulation observation (N=29)</td>
<td>Teamwork and Safety Climate Survey (perception measure) S.T.A.B.L.E. pre-post questionnaire (knowledge measure) TEAM (self-reported performance measure) ERPT (performance measure)</td>
<td>Teamwork and Safety Climate Survey increased compared to pre-training Perceived teamwork (TEAM scores) during resuscitation was significantly higher post-training compared to pre-training Statistically significant increase in knowledge assessment scores post-training ERPT performance scores statistically improved post-training compared to pre-training</td>
</tr>
</tbody>
</table>
Appendix B

Email Request for Video Use

Hello KSU Nursing Alum!

I hope this time of year finds you well and you are enjoying your career as a Baccalaureate nurse.

I am writing today to ask permission to utilize your videos recorded from the Acute Patient Deterioration nursing elective course you took from Dr. Hart during the Fall semester of 2011 (or Spring semester of 2012, depending on the student). I would like to use the recording as part of a dissertation study I am conducting for my doctoral degree. I am investigating the quality of a scoring tool used in the evaluation of team performance. Your anonymous recordings will be viewed and scored by a group of healthcare professionals who conduct team training of medical professionals. The scores collected will provide evidence of the effectiveness of the tool with an overall goal of improving patient safety through healthcare team training.

Please reply to this email and indicate if you do, or do not authorize the use of the video recordings.

Thank you for your consideration and I hope to hear from you soon!

Fondly,

Mary Beth Maguire
Appendix C
Former Student Video Recording Release

Research Media Records Release Form

You are being asked to authorize the use of simulation videos you participated in while enrolled in the Acute Patient Deterioration course at Kennesaw State University for the purpose of nursing research. Please indicate your authorization by signing below.

I understand the recordings will be studied by the research team for use in nursing research.

I understand the recordings may be shown to subjects in other experiments.

I understand the recordings may be used for scientific publications.

I understand the recordings may be shown at meetings of scientists interested in the study of team training.

I understand the recordings may be shown in classrooms to students.

I have read this form and give my consent for use of the recordings as indicated above.

Signature ________________________________ Date ____________________

Please return this document using the self-addressed stamped envelope enclosed.

If preferred, you can email your consent for recording use to:
mmaguir5@kennesaw.edu
Thank you!
Appendix D
Copy of Institutional Review Board Approval

1/26/2015

Mary Beth Maguire, RN
Wellstar School of Nursing
1000 Chastain Road
Kennesaw, GA 30144-5591

RE: Your application dated 1/12/2015, Study #15-218: Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

Dear Professor Maguire:
Your application for the new study listed above has been administratively reviewed. This study qualifies as exempt from continuing review under DHHS (OHRP) Title 45 CFR Part 46.101(b)(2) - educational tests, surveys, interviews, public observations. The consent procedures described in your application are in effect. You are free to conduct your study.

Please note that all proposed revisions to an exempt study require IRB review prior to implementation to ensure that the study continues to fall within an exempted category of research. A copy of revised documents with a description of planned changes should be submitted to irb@kennesaw.edu for review and approval by the IRB.

Thank you for keeping the board informed of your activities. Contact the IRB at irb@kennesaw.edu or at (470) 578-2268 if you have any questions or require further information.

Sincerely,
Christine Ziegler, Ph.D.
KSU Institutional Review Board Chair and Director

cc: mbremner@kennesaw.edu
Appendix E
Content Validity Index Survey
1. Please indicate your willingness to participate in the study:

- I agree and give my consent to participate in this research project. I understand that participation is voluntary and that I may withdraw my consent at any time without penalty.

- I do not agree to participate and will be excluded from the remainder of the questions.
Content Validity Testing the TeamSTEPPS 2.0 Team Performance

Demographics

Please answer each question below.

*1. Are you 18 years of age or older?
   - Yes
   - No

*2. Indicate your state and zip code of residence
   - State/Province
   - ZIP/Postal Code

3. Approximately how long have you engaged in team science?
   - Years
Content Validity Testing the TeamSTEPPS 2.0 Team Performance

TeamSTEPPS 2.0
Team Performance Observation Tool (TPOT)

Please review the concepts and related items below. Based upon your expertise of team science, rate each item.

1. The items below relate to team structure
   a. Assembles a team
   b. Assigns or identifies team members' roles and responsibilities
   c. Holds team members accountable
   d. Includes patients and families as part of the team

Comments

2. The items below relate to communication
   a. Provides brief, clear, specific, and timely information to team members
   b. Seeks information from all available sources
   c. Uses check-backs to verify information that is communicated
   d. Uses SBAR, call-outs, and handoff techniques to communicate effectively with team members

Comments
### 3. The items below relate to leadership

<table>
<thead>
<tr>
<th></th>
<th>1=Not Relevant</th>
<th>2=Somewhat Relevant</th>
<th>3=Quite Relevant</th>
<th>4=Highly Relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Identifies team goals and vision</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b. Uses resources efficiently to maximize team performance</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c. Balances workload within the team</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d. Delegates tasks or assignments, as appropriate</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>e. Conducts briefs, huddles, and debriefs</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Comments: 

### 4. The following items relate to situation monitoring

<table>
<thead>
<tr>
<th></th>
<th>1=Not Relevant</th>
<th>2=Somewhat Relevant</th>
<th>3=Quite Relevant</th>
<th>4=Highly Relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Monitors the status of the patient</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b. Monitors fellow team members to ensure safety and prevent errors</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c. Monitors the environment for safety and availability of resources (e.g., equipment)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d. Monitors progress toward the goal and identifies changes that could alter the plan of care</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>e. Fosters communication to ensure that team members have a shared mental model</td>
<td>☐</td>
<td>☐</td>
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</tr>
</tbody>
</table>

Comments: 

Page 5
Content Validity Testing the TeamSTEPPS 2.0 Team Performance

*5. The following items relate to mutual support*

<table>
<thead>
<tr>
<th></th>
<th>1=Not Relevant</th>
<th>2=Somewhat Relevant</th>
<th>3=Quite Relevant</th>
<th>4=Highly Relevant</th>
</tr>
</thead>
<tbody>
<tr>
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Comments

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Page 6
Content Validity Testing the TeamSTEPPS 2.0 Team Performance

Thank you!

Thank you for participating in this study.
Your expertise is appreciated and will serve to advance the science of healthcare teams.
Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

Online Survey Consent Form

Title of the Research Study:
"Testing the TeamSTEPPS 2.0 Team Performance Observation Tool".

Researcher's Contact Information:
Mary Beth Maguire MSN, RN, CNE
(470) 578-6301
mmaguire@kennesaw.edu

Introduction:
You are being invited to take part in a research study conducted by Mary Beth Maguire of Kennesaw State University. Before you decide to participate in this study, you should read this form and ask questions about anything you do not understand.

Description of Project:
The purpose of this study is to explore validity and reliability assessment of data produced from the scoring of five team performances using the TeamSTEPPS 2.0 Team Performance Observation Tool.

Explanation of Procedures:
You are being asked to view 5 videos of healthcare teams engaged in a simulated critical patient event. At the end of each video review you will be asked to score the performance using the TeamSTEPPS 2.0 Team Performance Observation Tool (TPOT) and the Team Emergency Assessment Measure (TEAM). The TEAM will serve as a method of concurrent validity data.
The survey will be returned to a random sample of participants to complete a second video review and scoring of the five performances approximately two weeks after scoring is completed in an effort to obtain test-retest reliability data.

Time Required:
The expected time to complete the video recording review and scoring instruments is approximately 90 minutes. A comfortable workspace with minimal distractions is encouraged.

Risks or Discomforts:
No anticipated risks or anticipated discomforts are anticipated as a result of participating in this research project.

Benefits:
There are no direct benefits to you for participating in the study however, knowledge gained from the study is expected to strengthen teamwork science and improve healthcare quality through improved team performance.

Compensation:
You will be awarded with a $25 Target gift card for viewing five videos and scoring each performance using the TPOT and TEAM instruments. Should you be selected to serve as a test-retest rater and complete a second viewing and scoring of the five performances you will be awarded with a $50 Visa gift card.

Confidentiality:
The results of this participation will remain confidential. Study data will remain on a password protected computer and any printed materials will remain in a locked drawer. The researcher will be the only person with access to this information.

Inclusion Criteria for Participation:
You must be 18 years of age or older to participate.
You must have completed a TeamSTEPPS training program.
A computer with internet connection and audio capabilities is required to view the videos and score the performances.
Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

Use of Online Survey:
IP addresses will not be collected.

Research at Kennesaw State University that involves human participants is carried out under the oversight of an Institutional Review Board. Questions or problems regarding these activities should be addressed to the Institutional Review Board, Kennesaw State University, 1000 Chastain Road, I-112, Kennesaw, Georgia 30040-5591, (678) 797-2268.

PLEASE PRINT A COPY OF THIS CONSENT DOCUMENT FOR YOUR RECORDS, OR IF YOU DO NOT HAVE PRINT CAPABILITIES, YOU MAY CONTACT THE RESEARCHER TO OBTAIN A COPY.

*1. Please indicate your willingness to participate in the study:

☐ I agree and give my consent to participate in this research project. I understand that participation is voluntary and that I may withdraw my consent at any time without penalty.

☐ I do not agree to participate and will be excluded from the remainder of the questions.
Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

Demographics

Please answer each question below.

*1. Please complete the following:
   The first three letters of your first name
   The first three letters of your last name

*2. Are you 18 years of age or older?
   ○ Yes
   ○ No

*3. In what year were you born? (enter 4-digit birth year; for example, 1976)

*4. What is your gender?
   ○ Female
   ○ Male

*5. Are you White, Black or African-American, American Indian or Alaskan Native, Asian, Native Hawaiian or other Pacific Islander, or some other race?
   ○ White
   ○ Black or African-American
   ○ American Indian or Alaskan Native
   ○ Asian
   ○ Native Hawaiian or other Pacific Islander
   ○ From multiple races
   Some other race (please specify):

*6. Indicate your state and zip code of residence
   State/Province
   ZIP/Postal Code
Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

*7. Indicate the type of program to which you are currently employed:
   - Academic
   - Inpatient
   - Outpatient
   - Industry
   - Other (please specify)

*8. Indicate the number of years you have been employed in this capacity:
   - 0-1 year
   - 2-5 years
   - 6-10 years
   - 11-15 years
   - 16-20 years
   - 20+ years

*9. Indicate the highest degree you have completed:
   - Associate’s Degree
   - Bachelor’s Degree
   - Master’s Degree
   - Doctoral Degree
   - Other (please specify)

*10. Indicate the year you completed TeamSTEPPS training

*11. Indicate your experience with the TeamSTEPPS curriculum (choose all that apply)
   - No experience, I do not utilize TeamSTEPPS skills within my role
   - I occasionally utilize TeamSTEPPS skills in my clinical practice
   - I routinely practice TeamSTEPPS skills in my clinical practice
   - I teach the TeamSTEPPS curriculum within my role
12. Indicate your experience with evaluating performance-based assessments:

- [ ] No experience
- [ ] I have some experience but not currently
- [ ] I am responsible for evaluating performance-based learning
- [ ] Other (please specify)   

[ ]  

[ ]  

Page 5
Testing the TeamSTEPPS 2.0 Team Performance Observation Tool (TPOT)

Use of Video Recording:
The use of the video recording you are about to view is for the sole purpose of this study and is only to be viewed by individuals participating in the study. The video is prohibited from being publicly displayed or reproduced.

Please click on the link below and view the video in its entirety. Once you have viewed the video, please rate the performance using the TPOT and TEAM instruments.

Video One:  
http://youtu.be/PG4zFXgalJ4

Consider observed behaviors only.  
When completing the rating scale for each item, make a judgment on the overall performance. Consider the global team performance, not performances by each individual.

<table>
<thead>
<tr>
<th><strong>1. Team Structure</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Assembles a team</td>
</tr>
<tr>
<td>b. Assigns or identifies team members' roles and responsibilities</td>
</tr>
<tr>
<td>c. Holds team members accountable</td>
</tr>
<tr>
<td>d. Includes patients and families as part of the team</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1=Very Poor</th>
<th>2=Poor</th>
<th>3=Acceptable</th>
<th>4=Good</th>
<th>5=Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
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</tbody>
</table>

Comments: ____________________________
## *2. Communication*

<table>
<thead>
<tr>
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</tbody>
</table>

**a.** Provides brief, clear, specific, and timely information to team members

**b.** Seeks information from all available sources

**c.** Uses checkbacks to verify information that is communicated

**d.** Uses SBAR, call-outs, and handoff techniques to communicate effectively with team members

**Comments**

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## *3. Leadership*

<table>
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<tr>
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</table>

**a.** Identifies team goals and vision

**b.** Uses resources efficiently to maximize team performance

**c.** Balances workload within the team

**d.** Delegates tasks or assignments, as appropriate

**e.** Conducts briefs, huddles, and debriefs

**Comments**
## Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

### 4. Situation Monitoring

<table>
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<tr>
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Comments:

### 5. Mutual Support

<table>
<thead>
<tr>
<th></th>
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<td>d. Uses the Two-Challenge Rule or DESC script to resolve conflict</td>
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</tr>
</tbody>
</table>

Comments:

Page 8
Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

TEAM Instrument

Regarding Video One:
This is a non-technical skills questionnaire and has been designed as an observational rating score for valid, reliable and feasible ratings of emergency medical teams (e.g. resuscitation and trauma teams).

Consider observed behaviors only.
When completing the rating scale for each item, make a judgment on the overall performance. Consider the global team performance, not performances by each individual.

*1. Leadership: It is assumed that the leader is either designated, has emerged or is the most senior-if no leader emerges allocate a '0' to question 1 and 2

<table>
<thead>
<tr>
<th>Item</th>
<th>0=Never/rarely</th>
<th>1=Seldom</th>
<th>2=About as often as not</th>
<th>3=Often</th>
<th>4=Always/Nearly always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The team leader let the team know what was expected of them through direction and command</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>2. The team leader maintained a global perspective</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

**Team Work: ratings should include the team as a whole: i.e. the leader and the team as a collective (to a greater or lesser extent).**

<table>
<thead>
<tr>
<th>3. The team communicated effectively</th>
<th>0=Hardly Ever</th>
<th>1=Seldom</th>
<th>2=About as often as not</th>
<th>3=Often</th>
<th>4=Always/Nearly always</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. The team worked together to complete the tasks in a timely manner</td>
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<td>5. The team acted with composure and control</td>
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<td>6. The team moral was positive</td>
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<td>7. The team adapted to changing situations</td>
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<tr>
<td>8. The team monitored and reassessed the situation</td>
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<tr>
<td>9. The team anticipated potential actions</td>
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</tr>
</tbody>
</table>

**Task Management**

| 10. The team prioritized tasks |
| 11. The team followed approved standards and guidelines |

Prompt: Some deviation may be appropriate?
Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

4. Overall: On a scale of 1-10 (1=poor, 10=excellent) give your global rating of the team’s non-technical performance
Use of Video Recording:
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Please click on the link below and view the video in its entirety. Once you have viewed the video, please rate the performance using the TPOT and TEAM instruments.

Video Two:
Insert Video Link Here

Consider observed behaviors only.
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<tr>
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<td>d. Includes patients and families as part of the team</td>
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Comments
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Comments:
**Testing the TeamSTEPPS 2.0 Team Performance Observation Tool**

### *4. Situation Monitoring*

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**Comments**

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</tbody>
</table>

**Comments**

---

*Page 14*
Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

Copy of page: TEAM Instrument

Regarding Video Two:
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Consider observed behaviors only.
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**1. Leadership: It is assumed that the leader is either designated, has emerged or is the most senior—if no leader emerges allocate a '0' to question 1 and 2**

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</table>

1. The team leader let the team know what was expected of them through direction and command

2. The team leader maintained a global perspective

*Prompts: Monitoring clinical procedures and the environment? Remaining 'hands off' as applicable? Appropriate delegation.*
### Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

**2. Team Work:** ratings should include the team as a whole: i.e. the leader and the team as a collective (to a greater or lesser extent).

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</table>

**3. Task Management**

<table>
<thead>
<tr>
<th></th>
<th>Never/Hardly ever</th>
<th>Seldom</th>
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Video Three:
[Insert Video Link Here]

Consider observed behaviors only.
When completing the rating scale for each item, make a judgment on the overall performance. Consider the global team performance, not performances by each individual.

**1. Team Structure**

<table>
<thead>
<tr>
<th>a. Assembles a team</th>
<th>1=Very Poor</th>
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<td>d. Includes patients and families as part of the team</td>
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</tbody>
</table>

Comments
Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

**2. Communication**

<table>
<thead>
<tr>
<th>1=Very Poor</th>
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</table>

- a. Provides brief, clear, specific, and timely information to team members
- b. Seeks information from all available sources
- c. Uses check-backs to verify information that is communicated
- d. Uses SBAR, call-outs, and handoff techniques to communicate effectively with team members

Comments

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</table>

- a. Identifies team goals and vision
- b. Uses resources efficiently to maximize team performance
- c. Balances workload within the team
- d. Delegates tasks or assignments, as appropriate
- e. Conducts briefs, huddles, and debriefs

Comments
### 4. Situation Monitoring

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<td>d.</td>
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<td>e.</td>
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Comments:

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### 5. Mutual Support

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<tr>
<td>2. The team leader maintained a global perspective</td>
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</tr>
</tbody>
</table>

*Prompts: Monitoring clinical procedures and the environment? Remaining "hands off" as applicable? Appropriate delegation.*
**2. Team Work:** ratings should include the team as a whole: i.e. the leader and the team as a collective (to a greater or lesser extent).

<table>
<thead>
<tr>
<th>Rating</th>
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<tbody>
<tr>
<td>3. The team communicated effectively</td>
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<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
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<td>Prompts: Verbal, non-verbal and written forms of communication?</td>
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</tr>
<tr>
<td>Prompts: Adaptation within the roles of their profession? Situation changes: Patient deterioration? Team changes?</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Prompts: Preparation of defibrillator, drugs, airway equipment?</td>
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**3. Task Management**

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<tr>
<td>Prompts: Some deviation may be appropriate?</td>
<td>○</td>
<td>○</td>
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</table>
4. Overall: On a scale of 1-10 (1=poor, 10=excellent) give your global rating of the team’s non-technical performance
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Video Four:
Insert Video Link Here

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Comments:
## Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

### 2. Communication

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<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>b. Seeks information from all available sources</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>c. Uses check-backs to verify information that is communicated</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>d. Uses SBAR, call-outs, and handoff techniques to communicate effectively with team members</td>
<td>O</td>
<td>O</td>
<td>O</td>
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</tr>
</tbody>
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Comments

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### 3. Leadership

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<tr>
<td>a. Identifies team goals and vision</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>b. Uses resources efficiently to maximize team performance</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>c. Balances workload within the team</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<tr>
<td>d. Delegates tasks or assignments, as appropriate</td>
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<td>O</td>
<td>O</td>
<td>O</td>
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<tr>
<td>e. Conducts briefs, huddles, and debriefs</td>
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<td>O</td>
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Comments

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### 4. Situation Monitoring

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<tbody>
<tr>
<td>a. Monitors the status of the patient</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
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</tr>
<tr>
<td>b. Monitors fellow team members to ensure safety and prevent errors</td>
<td>[ ]</td>
<td>[ ]</td>
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<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>c. Monitors the environment for safety and availability of resources (e.g., equipment)</td>
<td>[ ]</td>
<td>[ ]</td>
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<td>[ ]</td>
</tr>
<tr>
<td>d. Monitors progress toward the goal and identifies changes that could alter the plan of care</td>
<td>[ ]</td>
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</tr>
<tr>
<td>e. Fosters communication to ensure that team members have a shared mental model</td>
<td>[ ]</td>
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</tbody>
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**Comments**

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### 5. Mutual Support

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<th>5=Excellent</th>
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</thead>
<tbody>
<tr>
<td>a. Provides task-related support and assistance</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>b. Provides timely and constructive feedback to team members</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>c. Effectively advocates for patient safety using the Assertive Statement, Two-Challenge Rule, or CUS</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>d. Uses the Two-Challenge Rule or DESC Script to resolve conflict</td>
<td>[ ]</td>
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**Comments**

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Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

Copy of page: TEAM Instrument

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**2. Team Work: ratings should include the team as a whole: i.e. the leader and the team as a collective (to a greater or lesser extent).**

<table>
<thead>
<tr>
<th>3. The team communicated effectively</th>
<th>0=Hardly Ever</th>
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<table>
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<tr>
<th>4. The team worked together to complete the tasks in a timely manner</th>
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<td>Prompts: Appropriate support, confidence, spirit, optimism, determination?</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7. The team adapted to changing situations</th>
<th>0=Hardly Ever</th>
<th>1=Seldom</th>
<th>2=About as often as not</th>
<th>3=Often</th>
<th>4=Always/Nearly always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prompts: Adaptation within the roles of their profession? Situation changes: Patient deterioration? Team changes?</td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8. The team monitored and reassessed the situation</th>
<th>0=Hardly Ever</th>
<th>1=Seldom</th>
<th>2=About as often as not</th>
<th>3=Often</th>
<th>4=Always/Nearly always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prompts: Preparation of defibrillator, drugs, airway equipment?</td>
<td></td>
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</tr>
</tbody>
</table>

**3. Task Management**

<table>
<thead>
<tr>
<th>10. The team prioritized tasks</th>
<th>Never/Hardly ever</th>
<th>Seldom</th>
<th>About as often as not</th>
<th>Often</th>
<th>Always/Nearly always</th>
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<tr>
<td>Prompts: Some deviation may be appropriate?</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>11. The team followed approved standards and guidelines</th>
<th>0=Hardly Ever</th>
<th>1=Seldom</th>
<th>2=About as often as not</th>
<th>3=Often</th>
<th>4=Always/Nearly always</th>
</tr>
</thead>
</table>
*4. Overall: On a scale of 1-10 (1=poor, 10=excellent) give your global rating of the team’s non-technical performance

[ ]
Use of Video Recording:
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Please click on the link below and view the video in its entirety. Once you have viewed the video, please rate the performance using the TPOT and TEAM instruments.

* Video Five:
  * Insert Video Link Here

Consider observed behaviors only.
When completing the rating scale for each item, make a judgment on the overall performance. Consider the global team performance, not performances by each individual.

<table>
<thead>
<tr>
<th>1. Team Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1=Very Poor</td>
</tr>
<tr>
<td>a. Assembles a team</td>
</tr>
<tr>
<td>b. Assigns or identifies team members' roles and responsibilities</td>
</tr>
<tr>
<td>c. Holds team members accountable</td>
</tr>
<tr>
<td>d. Includes patients and families as part of the team</td>
</tr>
</tbody>
</table>

Comments: ___________________________
### Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

#### *2. Communication*

<table>
<thead>
<tr>
<th>a. Provides brief, clear, specific, and timely information to team members</th>
<th>1=Very Poor</th>
<th>2=Poor</th>
<th>3=Acceptable</th>
<th>4=Good</th>
<th>5=Excellent</th>
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</tbody>
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<table>
<thead>
<tr>
<th>b. Seeks information from all available sources</th>
<th>1=Very Poor</th>
<th>2=Poor</th>
<th>3=Acceptable</th>
<th>4=Good</th>
<th>5=Excellent</th>
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<thead>
<tr>
<th>c. Uses check-backs to verify information that is communicated</th>
<th>1=Very Poor</th>
<th>2=Poor</th>
<th>3=Acceptable</th>
<th>4=Good</th>
<th>5=Excellent</th>
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<tr>
<th>d. Uses SBAR, call-outs, and handoff techniques to communicate effectively with team members</th>
<th>1=Very Poor</th>
<th>2=Poor</th>
<th>3=Acceptable</th>
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**Comments**

#### *3. Leadership*

<table>
<thead>
<tr>
<th>a. Identifies team goals and vision</th>
<th>1=Very Poor</th>
<th>2=Poor</th>
<th>3=Acceptable</th>
<th>4=Good</th>
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<table>
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<tr>
<th>b. Uses resources efficiently to maximize team performance</th>
<th>1=Very Poor</th>
<th>2=Poor</th>
<th>3=Acceptable</th>
<th>4=Good</th>
<th>5=Excellent</th>
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<tr>
<th>c. Balances workload within the team</th>
<th>1=Very Poor</th>
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<tr>
<th>d. Delegates tasks or assignments, as appropriate</th>
<th>1=Very Poor</th>
<th>2=Poor</th>
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**Comments**
**Testing the TeamSTEPPS 2.0 Team Performance Observation Tool**

**4. Situation Monitoring**

<table>
<thead>
<tr>
<th>a. Monitors the status of the patient</th>
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<td></td>
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<tr>
<td>b. Monitors fellow team members to ensure safety and prevent errors</td>
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<td>c. Monitors the environment for safety and availability of resources (e.g., equipment)</td>
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<td>e. Fosters communication to ensure that team members have a shared mental model</td>
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</tbody>
</table>

Comments: ____________________________

**5. Mutual Support**

<table>
<thead>
<tr>
<th>a. Provides task-related support and assistance</th>
<th>1=Very Poor</th>
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<th>5=Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. Provides timely and constructive feedback to team members</td>
<td></td>
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<tr>
<td>c. Effectively advocates for patient safety using the Assertive Statement, Two-Challenge Rule, or CUS</td>
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<tr>
<td>d. Uses the Two-Challenge Rule or DESC Script to resolve conflict</td>
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Comments: ____________________________
Regarding Video Five:
This is a non-technical skills questionnaire and has been designed as an observational rating scale for valid, reliable and feasible ratings of emergency medical teams (e.g. resuscitation and trauma teams).

Consider observed behaviors only.
When completing the rating scale for each item, make a judgment on the overall performance. Consider the global team performance, not performances by each individual.

**1. Leadership: It is assumed that the leader is either designated, has emerged or is the most senior-if no leader emerges allocate a '0' to question 1 and 2**

<table>
<thead>
<tr>
<th>0=Never/Hardly ever</th>
<th>1=Seldom</th>
<th>2=About as often as not</th>
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<tr>
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<tr>
<td>1. The team leader let the team know what was expected of them through direction and command</td>
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<tr>
<td>2. The team leader maintained a global perspective</td>
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</tbody>
</table>

**Prompts:** Monitoring clinical procedures and the environment? Remaining "hands off" as applicable? Appropriate delegation.
Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

**2. Team Work:** ratings should include the team as a whole: i.e. the leader and the team as a collective (to a greater or lesser extent).

<table>
<thead>
<tr>
<th>Rating</th>
<th>0=Hardly Ever</th>
<th>1=Seldom</th>
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<th>4=Always/Nearly always</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. The team communicated effectively</td>
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<td>4. The team worked together to complete the tasks in a timely manner</td>
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<td>5. The team acted with composure and control</td>
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<tr>
<td>6. The team morale was positive</td>
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<tr>
<td>7. The team adapted to changing situations</td>
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<tr>
<td>8. The team monitored and reassessed the situation</td>
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<tr>
<td>9. The team anticipated potential actions</td>
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</tbody>
</table>

**3. Task Management**

<table>
<thead>
<tr>
<th>Rating</th>
<th>Never/Hardly ever</th>
<th>Seldom</th>
<th>About as often as not</th>
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</thead>
<tbody>
<tr>
<td>10. The team prioritized tasks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

*Prompt: Some deviation may be appropriate?
Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

4. Overall: On a scale of 1-10 (1=poor, 10=excellent) give your global rating of the team’s non-technical performance

<table>
<thead>
<tr>
<th>Rating:</th>
</tr>
</thead>
</table>

Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

Incentive & Rater Invitation

1. Please indicate if you would like to receive a $25 Target gift card for completing the study

2. If you would like to receive a $25 Target Gift Card please complete your preferred mailing address and contact information below.

   Name
   Address
   Address 2
   City/Town
   State/Province
   ZIP/Postal Code
   Country
   Email Address
   Phone Number
Testing the TeamSTEPPS 2.0 Team Performance Observation Tool

Thank you!

Thank you for participating in this study.
Your expertise is appreciated and will serve to advance the science of healthcare teams.
TeamSTEPPS 2.0 TPOT Retest Survey

Online Survey Consent Form

Title of the Research Study:
"Testing the TeamSTEPPS 2.0 Team Performance Observation Tool".

Researcher's Contact Information:
Mary Beth Maguire MSN, RN, CNE
(470) 578-6301
mmaguire5@kennesaw.edu

Introduction:
You are being invited to take part in a research study conducted by Mary Beth Maguire of Kennesaw State University. Before you decide to participate in this study, you should read this form and ask questions about anything you do not understand.

Description of Project:
The purpose of this study is to explore test-retest reliability assessment of data produced from the scoring of five team performances using the TeamSTEPPS 2.0 Team Performance Observation Tool.

Explanation of Procedures:
You are being asked to view the same 5 videos of healthcare teams engaged in a simulated critical patient event you have reviewed previously. At the end of each video review you will be asked to score the performance using the TeamSTEPPS 2.0 Team Performance Observation Tool (TPOT).

Time Required:
The expected time to complete the video recording review and scoring instruments is approximately 60 minutes. A comfortable workspace with minimal distractions is encouraged.

Risks or Discomforts:
No anticipated risks or anticipated discomforts are anticipated as a result of participating in this research project.

Benefits:
There are no direct benefits to you for participating in the study however, knowledge gained from the study is expected to strengthen teamwork science and improve healthcare quality through improved team performance.

Compensation:
You will be awarded with a $50 Visa gift card for viewing five videos and scoring each performance using the TPOT instrument.

Confidentiality:
The results of this participation will remain confidential. Study data will remain on a password protected computer and any printed materials will remain in a locked drawer. The researcher will be the only person with access to this information.

Inclusion Criteria for Participation:
You must be 18 years of age or older to participate.
You must have completed a TeamSTEPPS training program.
A computer with Internet connection and audio capabilities is required to view the videos and score the performances.

Use of Online Survey:
IP addresses will not be collected.

Research at Kennesaw State University that involves human participants is carried out under the oversight of an Institutional Review Board. Questions or problems regarding these activities should be addressed to the Institutional
*1. Please indicate your willingness to participate in the study:

- I agree and give my consent to participate in this research project. I understand that participation is voluntary and that I may withdraw my consent at any time without penalty.
- I do not agree to participate and will be excluded from the remainder of the questions.
TeamSTEPPS 2.0 TPOT Retest Survey

Demographics

Please answer the following question.

**1. Please complete the following:**

The first three letters of your first name

The first three letters of your last name
**TeamSTEPPS 2.0 TPOT Retest Survey**

**TeamSTEPPS 2.0**  
Team Performance Observation Tool (TPOT)

**Use of Video Recording:**  
The use of the video recording you are about to view is for the sole purpose of this study and is only to be viewed by individuals participating in the study. The video is prohibited from being publicly displayed or reproduced.

Please click on the link below and view the video in its entirety. Once you have viewed the video, please rate the performance using the TPOT and TEAM instruments.

**Video One:**  
http://youtu.be/Pg4zFXgaxI4

Consider observed behaviors only.  
When completing the rating scale for each item, make a judgment on the overall performance. Consider the global team performance, not performances by each individual.

**1. Team Structure**

<table>
<thead>
<tr>
<th></th>
<th>1=Very Poor</th>
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<tbody>
<tr>
<td>a. Assembles a team</td>
<td>[ ]</td>
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<td>c. Holds team members accountable</td>
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<td>d. Includes patients and families as part of the team</td>
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**Comments**

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### 2. Communication

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Comments

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### 3. Leadership

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Comments
### 4. Situation Monitoring

- **a. Monitors the status of the patient**
- **b. Monitors fellow team members to ensure safety and prevent errors**
- **c. Monitors the environment for safety and availability of resources (e.g., equipment)**
- **d. Monitors progress toward the goal and identifies changes that could alter the plan of care**
- **e. Fosters communication to ensure that team members have a shared mental model**

**Comments**

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### 5. Mutual Support

- **a. Provides task-related support and assistance**
- **b. Provides timely and constructive feedback to team members**
- **c. Effectively advocates for patient safety using the Assertive Statement, Two-Challenge Rule, or CUS**
- **d. Uses the Two-Challenge Rule or DESC Script to resolve conflict**

**Comments**

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**TeamSTEPPS 2.0 TPOT Retest Survey**

**Copy of page: TeamSTEPPS 2.0**

**Team Performance Observation Tool (TPO)**

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**Use of Video Recording:**
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Please click on the link below and view the video in its entirety. Once you have viewed the video, please rate the performance using the TPOT and TEAM instruments.

**Video Two:**
Insert Video Link Here

Consider observed behaviors only.
When completing the rating scale for each item, make a judgment on the overall performance. Consider the global team performance, not performances by each individual.

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**1. Team Structure**

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Comments

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### TeamSTEPPS 2.0 TPOT Retest Survey

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Page 8
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## 4. Situation Monitoring

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## Copy of page: TeamSTEPPS 2.0

**Team Performance Observation Tool (TPO)**

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**Video Three:**
Insert Video Link Here

Consider observed behaviors only.
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Comments:

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**Page 10**
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Comments

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Comments

Page 11
### 4. Situation Monitoring

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**Comments**

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Video Four:
Insert Video Link Here

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Comments
### TeamSTEPPS 2.0 TPOT Retest Survey

#### 2. Communication

- **a.** Provides brief, clear, specific, and timely information to team members
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Comments: ____________________________
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# TeamSTEPPS 2.0 TPOT Retest Survey

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Comments:
TeamSTEPPS 2.0 TPOT Retest Survey

Incentive

*1. Please indicate if you would like to receive a $50 Visa gift card for completing the study

2. If you would like to receive a $50 Visa Gift Card please complete your preferred mailing address and contact information below.

   Name
   Address
   Address 2
   City/Town
   State/Province
   ZIP/Postal Code
   Country
   Email Address
   Phone Number
TeamSTEPPS 2.0 TPOT Retest Survey

Thank you!

Thank you for participating in this study.
Your expertise is appreciated and will serve to advance the science of healthcare teams.